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SCIENTIFIC TERMINOLOGY IN INDIAN LANGUAGES

A QUESTION of capital significance to the cause of science in India is that of a standard terminology in Indian languages for scientific and technical ideas and objects. With the growth of the movement for the adoption of our various provincial vernaculars as the media of instruction in schools and even in colleges in the several Provinces, the importance of the question has naturally increased; and some provincial Governments have given evidence of their appreciation of the fact. In June last year, the Government of Madras appointed a committee to consider (1) to what extent the equivalents of foreign technical terms already in use in the South Indian languages are acceptable for educational purposes; (2) whether it is desirable to retain for school purposes the use of English technical terms where there are no accepted equivalents in the South Indian languages; and (3) whether, in the alternative, it is necessary to draw up new and standardised lists of equivalents of certain foreign technical terms for all the South Indian languages.

The Committee was composed of fifteen members all of whom are scholars and educationists of high standing, some representing High School experience and others College experience. The Rt. Hon'ble V. S. SRINIVASA SASTRI was its chairman. After considering the various suggestions placed before it, the Committee formulated its recommendations and submitted them to the Government in September last year. The Government of Madras has "accepted the recommendations" and has appointed (or is about to appoint) a special committee for each of the South Indian languages as

suggested by the Sastri Committee. The principal recommendations of the Sastri Committee may be summarized as follows:—

1. (*a*) The equivalents of foreign technical terms which are already in use in accepted educational publications may continue to be used; and (*b*) other expressions current in popular usage (pertaining to ordinary concrete objects or natural phenomena like mule or metal, thunder or earthquake) may be adopted for school use. Under this head each South Indian language may have its own vocabulary.

2. For names of conceptual or abstract objects or ideas (like those of physics or physiology, mathematics or philosophy), a list common to all South Indian languages should be drawn up; and in the coining of such new words the bases may be adopted from Sanskrit for Dravidian languages, and from Persian and Arabic for Urdu.

3. Words not falling within the above two groups,—that is, non-Indian technical words which neither have vernacular equivalents already current, nor are amenable to the treatment suggested under the second head,—should be taken as they are from English and suitably transliterated for the Tamil or Telugu or Kannada or Malayalam reader.

It should be noted that the task set to the Committee was the modest one of helping education in schools, and not the rather ambitious one of providing for advanced study and independent research in science through the medium of Tamil or Kannada or Telugu. For the limited purpose which the Committee had in view, its recommendations should ordinarily have been accepted as appropriate and sufficient. But the case of South India has now been made to look out of the ordinary by the insistence of some Tamil revivalists on linguistic purism. They are opposed to the Sastri Committee's suggestion in favour of Sanskrit as a radical for the coining of new words. The Committee has taken care to point out that the group of words thus to be coined "will necessarily be small"; but even in that meagre proportion of the scientific vocabulary of the Tamilian, the Tamil purists are not prepared to have the help of Sanskrit. It is unfortunate in the extreme that unanimity should thus have been rendered unattainable in this country even in a field of life so far apart from politics.

To insist on unmixed Dravidism in current Tamil or current Kannada is not unlike the movement of some years ago to establish the reign of Saxonism in current English. What the author of *King's English* says about that movement is apposite to our purpose:—

"The Saxonist (*i*) forms new derivatives from English words to displace established words of similar meaning, but Latin descent; (*ii*) revives obsolete or archaic English words for the same purpose; (*iii*) allows the genealogy of words to decide for him which is the better of two synonyms ... The wisdom of this nationalism in language—at least in so thoroughly composite a language as English—is very questionable; we may well doubt whether it benefits the language; and that it does not benefit the style of the individual ..... is pretty clear ..... The truth is perhaps that conscious deliberate Saxonism is folly, that the choice or rejection of particular words should depend not on their descent, but on considerations of expressiveness, intelligibility, brevity, euphony or ease of handling."—FOWLER, *Modern English Usage*.

The subject is surely one that should be viewed from a higher standpoint than that of linguistic purism and of provincialism of every kind. The first consideration to be borne in mind is that of facilitating the spread of the knowledge of science in the country, whichever the linguistic medium employed. It should, by every means within our reach, be made easy for the school student, and

for the man in the street too, to acquire knowledge—clear and accurate knowledge—of the thought and the achievements of science in its various manifestations; and then, incidentally and without prejudice to the first named object, all-Indian uniformity and approximation to international phraseology should be attempted, even this second consideration being meant to help the first.

It is also necessary to make a special note of another point, namely, the peculiar requirements of terminology in science as distinguished from terminology in arts or those aspects of arts that do not lend themselves to scientific treatment. The operations of science are objective, that is, accessible to measurement and verification by means and methods that can be reported and reproduced. On the other hand, the province of artistic activity is subjective and private, belonging to a realm where every man has his own separate yard-wand and his own independent criteria of judgment not necessarily shared by others. The scientist looks outside for verification and corroboration. To the artist, his own inner testimony is supreme. The varieties of literary artifice available to a poet or a novelist to communicate the nebulous and the twilight-ish charms of the picture that his mind sees,—the graphic epithet, the rhetorical synonym, the vivid periphrasis,—these may not be permitted to a scientist in the statement of his theory or observation. What is of value to the artist in a word is its suggestiveness, its *vyangya*, that which lies *implicit* in the word. What is of value to the scientist, on the other hand, is its expressiveness, its *vachya*, that which is made *explicit* by it. *The* scientist's terms should therefore be exact in their denotation, each term standing for one definite thing and no more than one. It is hardly necessary to add that this remark applies not only to the various natural and social sciences, but also to the scientific aspects of even arts like music or literature, indeed, to all which human intelligence hopes to analyse and relate as cause and effect.

The conditions, then, which a vocabulary for science should satisfy may be set down generally as follows:—

(1) *Intelligibility.*—This includes the qualities of simplicity, directness, brevity, lucidity and also forcefulness. It should be possible for the average man to comprehend the meaning of the word without much etymological or philological learning. This would mean that the words should, as far as possible, be those in current use or readily recognizable as related to words in current use.

(2) *Accuracy.*—The words should, as pointed out above, have definite and fixed meanings and should not be interchangeable. The weakness of a goodly percentage of words in Indian languages is in their inexactness and their liability to varieties of construction and in their potency to cause confusion. Great, therefore, is the need for care in selecting the bases from the word-stock of an Indian language for the forming of a new phrase.

(3) *Harmony.*—This is the fitness of the word to its context in both sound and sense. It is not rarely that the dictionary is seen to furnish more words than one to denote a single object or idea; but a good writer will not pick up any one word from that list indifferently for his sentence, but will rather choose one particular word out of those several as peculiarly suited to convey his meaning in his verbal framework. Just as we judge of a man's sociability by observing his behaviour in company, we are able to evaluate the peculiar merit of a word when we try it in a given juxtaposition. Each language has its own peculiarities of word-structure and syntax, as well as of sound-value and rhythm; and any new word we coin or borrow must be appropriate to the idiom and to the euphony of our language.

(4) *Extensiveness of currency.*—The words should be as far as possible such as can facilitate (i) not only the acquisition of knowledge by the student individually and at a particular stage of his education, but also (ii) his discussing about it and sharing it with his fellow-students and even communicating it to others, on as large a scale as possible, and further (iii) his using that knowledge as the basis for his higher education outside his Province and outside India.

It is in the very nature of the thing impossible to lay down any hard and fast rules as to the method of providing the needed vocabulary. The method to be adopted must necessarily depend upon the nature of the word we want, the intricacy or the abstruseness of its content, the duties it will have to perform and so forth. The principles above indicated, will have to be applied both separately and jointly in each single case. None of the four tests can be dispensed with: simplicity, precision, euphony and wide currency. If these principles are approved, the following conclusions would seem to be inevitable:

(1) The books now in use on science subjects in the various Indian languages (including school-books, glossaries and dictionaries) should be examined carefully, and expressions already well established in usage in any language should be approved as a permanent part of the vocabulary of that language. Similar recognition should be extended to words and phrases found to be common in popular speech, provided of course there is no objection on the score of grammar or good taste. Indeed, when the man in the street habitually employs a foreign term (like court, inspector, motor, bicycle) in preference to a possible Sanskritic or other Indian equivalent, one may in a majority of cases conclude that the foreign phrase has a superior claim either in its ease of enunciation or its brevity or its precision or its compendiousness.

(2) Where the ideas or the objects are altogether new and are therefore without established equivalents in Indian languages, words based on Sanskrit roots should be coined, such coinings being of course subject to the tests of simplicity, definiteness and euphony. Sanskrit has three advantages to offer which no other Indian language has: (i) it has its own age-old stores of scientific terms in its books on astronomy, mathematics, law, music, medicine and metaphysics. These ancient mintages are a source which it would be suicidal for India not to utilize, of course subject to the tests mentioned. (ii) The wealth or its sematic potential, particularly in its *dhatu* or verbal rudiments, can be manipulated to varieties of purposes by means of varieties of prefixes and suffixes (*pratyayas*). (iii) It is easily accepted and understood throughout India and this can satisfy the fourth canon noted above. It was surely a most wholesome instinct, and no lack of patriotism, that made the great Sri Vaishnava thinkers and sages of old adopt the style of mixed Tamil and Sanskrit called *mani-pravala* (diamond and coral) for the outpourings of their hearts and souls.

(3) Even with the most skilled and the most assiduous effort at word-coining, a great many words of science must remain inconvertible into single equivalent words in any Indian language. The growth of science, and therefore that of the vocabulary of science, has been taking place at so rapid a rate that it must be beyond the hope of even the most daring and energetic of any vernacular lexicographer in India to keep pace with it. This very prolificness of the growth, as well as the intricacy and abstruseness, of the words of science in its modern developments makes it imperative that we should be prepared to import large quantities of them *en bloc* into our languages from English, transliterating them after suitably modifying their pronunciation and even their spelling to the extent necessitated by the peculiar accent and sound quality of our language. It does not seriously matter if the Bengali or the Mahratti or the Tamil alphabet cannot find symbols for the sound of "*z*" or "*x*" or "*f*" or "*a*" or "*æ*". The nearest Sanskritic or Dravidian letter may well be asked to deputize. Recognizability is all we need look for. It should not be forgotten that the terms contemplated under this third head are mostly those of advanced science, the pursuit of which in any case would be impossible without proficiency in English or some other foreign language.

We must also remember that it will not be enough if we have succeeded in minting one single equivalent for one term in a group of correlated terms. We should then pause to see how the shining output of our mint will serve as a basis for further derivatives and how it would behave amidst its cognates and correlatives; for the possibility of the growth of such correlatives and derivatives in science vocabulary in English seems, to judge from experience, to be practically without limit.

Let us look at the history of English, the nearest among the world's languages to the ideal of a universal tongue and the language, at the same time, of perhaps the most successful people as yet in history. Says Dr. J. H. Jagger:—

"Although the structure of modern English is quite different from the structure of Latin, any one who looked at the vocabulary only might well consider English to be a descendant of Latin, for the Latin importations actually outnumber the native stock ..... While Latin has given a larger number of words to the English vocabulary than any other foreign tongue, and while French has sent us more than any other during the last century, at the present moment, ancient Greek easily heads the list of our contributors. For the great developments in industry, science and speculative thought that have occurred in modern times, the Teutonic stock in English is unfitted; and the springs of Latin were beginning to dry up when the nineteenth century dawned. In these circumstances we turned to a quarry we had already opened in Ancient Greek. From it we have since drawn large supplies of material, most of which we have used for manufacturing words that would have been a source of wonder to the Greeks. The connotation of such a word as *thermometer* they would easily have understood, but to imagine the actual instrument would have been quite beyond their power. English, of course, was perfectly able to provide us with the compound *heat-measurer*, which is self-explanatory, but would have been unsuitable because it lacks precision. It might cover other objects, while the word *thermometer* can be restricted to a single type of apparatus."

And here is the finding of an authority regarding the contribution of Greek to English:—

"The register presents a selective list of about 130,000 words. It does not purport to present *all* the English words hitherto derived or constructed from Greek. Botany, medicine, etc., swell the total to *upward of a million* words. And even if all these were recorded, the rate of new coinage must soon render any list incomplete."

There have been humanitarian thinkers since ancient times who have insisted on our regarding our whole race as but one family and suggested various measures for our realizing that ideal in tangible fact. One such suggestion has been that of an international language to supplement or complement the national or the regional. Dr. J. H. Jagger writes:—

"One of the greatest needs of the world at the present day is a universal speech ..... Physical unity has been achieved, but the universal consciousness that should be its parallel has not been achieved, because of the obstacles created by differences of speech. Not a universal consciousness only; a universal conscience also. Since nations speaking different tongues are with respect to each other in a position analogous to that occupied by individuals who cannot comprehend each other, until mankind has attained a universal speech, it will not be able to frame the universal ideals that will enable it to press forward as a single whole towards a freer, wider life of the spirit."

If this larger hope should ever come to be fulfilled, it is essential that every country under the sun should agree to cultivate a common international tongue as auxiliary to its own national tongue. The task here is not one of abolishing nationalism or obliterating patriotism, but one of demarcating moral jurisdictions and apportioning

loyalties. There is no necessary conflict among them. When soberly viewed, they appear rather as mutually justificatory. This distribution and adjustment of our linguistic loyalties is only a necessary counterpart to the marking out of the spheres of our citizenship as municipal, national and international. To the citizen of India, the claims presented for adjustment are three,—the provincial, the national and the international. The adoption of Sanskrit and English, in the main, for the second and third purposes respectively will go far towards lightening the burden of word-lore for him. One detail which the linguistic fanatic is apt to forget is that the content of a word is of greater consequence than the word itself, that language is merely the means, and that there are strict limits to the demands that can be made upon the average man's time and energy and enthusiasm by etymology and grammar, all-important though they be to the philological Pandit.

The last War taught, or in any case was supposed to have taught, the world that "nationalism is not enough". More recent events have been teaching us that nationalism, exclusive and absolute, is in fact impossible. Science itself has brought about this commingling of the lives of the nations; and particularly at the present crisis in our civilization, the larger the area of common usage and first-hand intercourse between country and country, the greater the security for international fellow-feeling and the larger the chance of equity and balance in the standards of wealth and welfare among the various peoples. When such is the consideration that should be supreme in every field of human activity, a rigid adherence to particularism and provincialism as regards the medium of knowledge and culture would be nothing but a pitiful process of stunting our own intellectual and moral growth. Science, as it has gone on drawing the several parts of the globe nearer to one another, has also gone on developing a vocabulary of its own which must be regarded as international. A bigoted and self-sufficient nationalism has been the tragic folly of several countries in the past. Just as there are spheres and levels of life, appropriate to nationalism, we must recognize that there are other spheres appropriate only to internationalism. The commerce of culture, the diffusion of knowledge and the pursuit of science which is search for the laws of the workshop of Nature and the truths of life—these belong to the higher levels; and Indians would be anticipating that better future for which the world is longing, and setting an example to others, in being all-Indian and international in their policy as regards the compilation of their scientific vocabulary.

When so much has been said in favour of India's adopting English for its scientific vocabulary in the higher grades, it seems necessary to say a word to prevent any misunderstanding of our attitude as one of insufficient appreciation of the importance of developing Indian languages. The importance of these languages is undoubted; and they cannot afford to forego the contribution which the development of a scientific literature can make to their growth. But the question at the moment is—of the two extremely desirable objects we have before us, namely, diffusion of the knowledge of science and development of the local language, which do we want more urgently?

It is impossible that both can be secured equally well at one and the same time. To us it seems, firstly, that the knowledge of science and of modern world-conditions is more urgently needed, and, secondly, that the development of vocabulary is bound to be a matter of slow growth in any case. It will, we think, be no advantage to the country to hold up the progress of education in science by the reason or unreason of our linguistic difficulties. There are a great many good things in this world all equally to be desired. But it would only make for waste of time and effort if we tried to snatch all of them at once by one single grasp of the hand. We have to postpone some in order that we may be sure of getting hold of the others.

It must also be recognised that it is given to no language to do equally well in all departments of service. Some excel in some and others in others. If Italy excelled in music, England was ready to borrow musical phraseology from there. If France was eminent in the culinary art, England was similarly prompt again. There are fields of life and achievement in which it has been given to Indian languages to attain high success. In the realms of the mind and the spirit, in poetry and philosophy, Sanskrit has made a record which is the envy and the admiration of other languages. The remembrance of the distinctiveness of the gifts and merits of the various languages of the world should be an influence for moderation on our linguistic patriotisms. If each separate language had not had an ethos of its own and a separate "mission" of its own, there would be no justification for the world's allowing so many languages to live and thrive. Diversity has its uses, like unity; and it profits nobody to bewail that any one's single language cannot do *all* things or have *all* things desirable. The greater destiny of the Indian languages is before them—yet to come as the crown of their present enrichment and growth.

The problem, as we have said, is not one confined in its significance to any one region or province, but relates to the whole of India. It therefore needs to be taken up by an all-India agency. His Excellency LORD LINLITHGOW will have rendered a service of first-class importance to India if he would move his Government to set up a special all-India committee to consider this matter in all its bearings and, in consultation with the Inter-University Board, the All-India Educational Conference, the Indian Science Congress and similar other bodies, to formulate proposals for the compilation of Scientific and Technical vocabularies in two grades, one for each important linguistic area and limited to the simpler and more easy objects and ideas, and the other for the whole of India and extending to complex and difficult items of scientific knowledge and thought. The urgency of the matter must be obvious to every one who has appreciated how far behind Europe and America and Japan this country is in respect of the power which science has made available to man.

D. V. G.

THE SEVERE MAGNETIC STORM OF SEPTEMBER 18, 1941

BY

M. R. RANGASWAMI AND A. S. CHAUBAL

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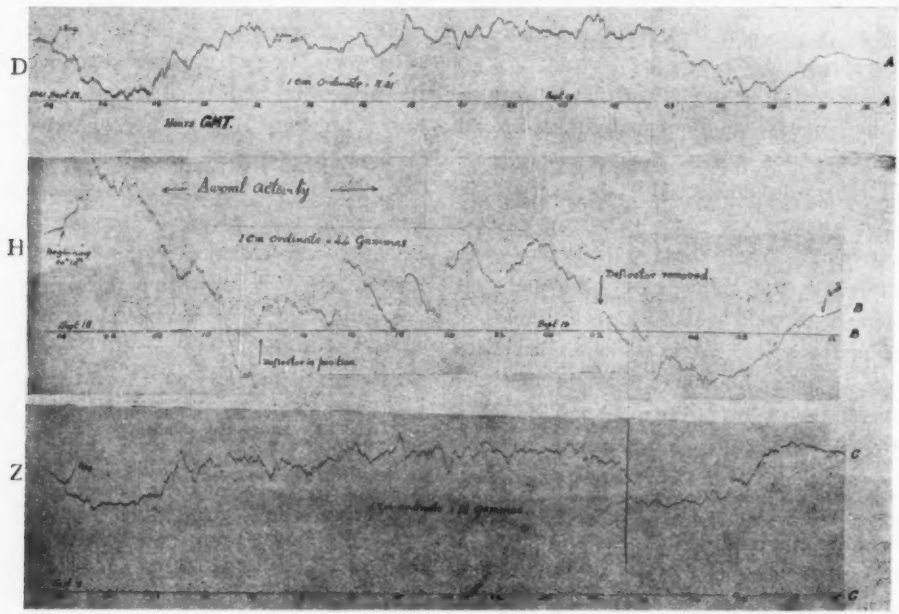
AT 4h 14m G.M.T. (corresponding to 9h 44m Indian Standard Time) on Thursday, the 18th September 1941, the magnetographs at the Alibag Magnetic Observatory recorded the commencement of a severe magnetic storm which upset wireless and telegraph traffic all over the world. According to Reuter's reports, there was a display of Aurora Borealis for two nights in succession from the 18th September 1941 and the lights which were very brilliant were seen from many parts of Britain particularly in East Anglia. The Indian Telegraph Department experienced considerable disturbances on their circuits and made very frequent telegraphic enquiries from the Alibag observatory which promptly gave the details regarding the progress of the storm. In India, receptions of the broadcasts of the B.B.C. and other foreign stations were also affected.

The storm can be considered to be the severest of its kind during the current year. The two other storms of importance during the year were those of 1st March 1941 and 5th July 1941. Both these storms were of severe intensity and caused moderate dislocation to the telegraph traffic. A detailed description of one of these storms, *viz.*, that of March 1, 1941, which was the intenser of the two, has been given in a note by one of us in an earlier issue of that Journal.

The magnetograms of the few days prior to the day of the storm do not indicate any special activity. The days 14th to 17th September 1941 were slightly disturbed being of international character No. 1. On the 17th, the day previous to the storm however, the Solar Physics Observatory at Kodaikanal observed a large sun-spot group crossing the central meridian. This spot



Severe Magnetic Storm of 18th September 1941. (D. H. & Z. Magnetograms recorded at the Alibag Observatory)

activity may perhaps be associated with the severe storm of the 18th September.

Characteristics of the storm of September 18, 1941.—The beginning of the present storm of September 18, 1941, was marked by a sudden rise of 26 gammas in horizontal force *H*, and of 1·3 minutes in Westerly declination *D* and a fall of 9 gammas in the vertical force *Z*. *H* rose gradually till $4^h\ 48^m$ G.M.T. and after this the magnet became quite unsteady with low-period oscillations of varying amplitudes. At $5^h\ 7^m$, *H* shot up rapidly by 141 gammas in barely fourteen minutes. At about $5^h\ 22^m$, the maximum value in *H* occurred but the position of the light speck was just beyond the recording limit of the photographic paper. The value of *H* at this time was more than 470 gammas above the baseline value. The vertical force attained its minimum value at about the same time. Westerly *D* attained its maximum value at $7^h\ 10^m$. A gradual fall in *H* associated with rapid vibrations commenced at $5^h\ 26^m$ and continued till $10^h\ 36^m$ when a large decrease of 224 gammas occurred in 52 minutes. At this time the value of *H* oscillated about this value for about 20 minutes and showed a tendency to fall rapidly from $11^h\ 50^m$ onwards. The value of *H* rapidly decreased and as there was the risk of the light speck going off the recording limit of the photogram, a deflecting magnet was used at $12^h\ 6^m$ and the trace was shifted upwards by 169 gammas. Rapid fluctuations in *H* were continuing till $15^h\ 20^m$ when there was a sudden rise of 144 gammas in about twenty minutes. From $15^h\ 44^m$ *H* began to fall again to attain its minimum at $17^h\ 50^m$. Both the vertical force and westerly *D* attained their maxima a few minutes after *H* reached its minimum value. Immediately after attaining the minimum *H* rose by 149 gammas in twenty-four minutes and thereafter rose and fell at stages with ups and downs such as have been noticed in terrestrial magnetic records associated with Auroral activity. As the need for a deflector magnet disappeared, it was removed from its position at $2^h\ 16^m$ on the 19th, resulting in the curve being shifted downwards by 158 gammas. The *H*, *D* and *Z* magnetics continued unsteady till $6^h\ 44^m$ on the 19th September, after which *H* began to rise very gradually with minor fluctuations. The range in horizontal force during the storm exceeded 650 gammas, while the ranges of *D* and *Z* were 12·0 minutes and 87 gammas respectively. The storm practically ended at $11{\cdot}5^h$ on the 19th although *H* continued low for a couple of days.

The magnetograms of the day of the storm as recorded at the Alibag Observatory have been reproduced in the figure.

WHISTLING METEORS. A DOPPLER EFFECT PRODUCED BY METEORS ENTERING THE IONOSPHERE

THE Research Department of All-India Radio has recently concluded an investigation of an effect hitherto unobserved. It is reported that the flight of meteors through the upper atmosphere, which results in clouds of ionized gases following the meteors at their tremendously high velocities of several kilometres per second, gives rise under certain conditions to peculiar types of low frequency whistles on the unmodulated carrier waves from nearby shortwave transmitters. The production of these whistles is explained on the basis of interference between the ground wave and a weak sky wave which has undergone a slight change in its frequency due to 'Doppler Effect', *i.e.*, due to reflection from the head of the rapidly moving ionized cloud caused by the passage of a meteor. This conclusion which is supported by observations and experiments is likely to be of far-reaching importance in the realm of astronomy. A detailed account of the investigation appears elsewhere.

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WHY GRAVITATION?

No gravitational theory has so far been able to explain gravitation, that is, why masses attract and do not repel. m/r satisfies Laplace's equation, m being a constant, positive or negative and r having the usual meaning. So also the static solution of Einstein's field equations, *viz.*,

$$ds^2 = -dr^2(1-2m/r)^{-1} - r^2(d\theta^2+\sin^2\theta d\theta^2) + c^2(1-2m/r)dt^2 \quad (1)$$

introduces m as a constant of integration which may be positive as well as negative. The question is whether we can deduce from first principles that

$$m > 0 \quad (2)$$

under all circumstances. It is, no doubt, a question of considerable historical interest and it has acquired some additional interest because of the recent discovery that protons at nuclear distances *attract* each other.

Lanczos[1] has recently published a theory to justify (2) in (1). He gives arguments for assuming

$$R_{ij}\,g^{ij} \equiv R = 0 \quad (3)$$

in a particle, R being the linear scalar invariant of the contracted Riemann-Christoffel tensor. The condition (3) makes m of the second order of smallness and positive. This procedure is unsatisfactory on account of the introduction of a new assumption (3) and also because of the new numerical relation that follows between inertial and gravitational masses. Although Lanczos[2] has found arguments in support of the numerical relation the consequences of (3) appear to weaken the case for that assumption.

A simple consideration may be presented how (2) is implicit in (1) on account of the relativity hypothesis that no observable velocity can exceed the velocity of light in ether, c. The apparent velocity of light in a field of force can be different from c. In electromagnetic[3] fields we know why the apparent velocity of light is less than c. In a radial direction the velocity of light in the gravitational field of a particle is

$$v_r = c(1-2m/r)$$

while, in a transverse direction, the velocity is

$$v_t = c\,(1-2m/r)^{\frac{1}{2}}.$$

If the observed values of v_r and v_t are not to exceed c it is necessary that (2) be satisfied. It is thus clear that the observed property of gravitation or attraction of particles in deducible, within the framework of general relativity, from the hypothesis that an observable velocity cannot exceed c. For a deeper understanding of the phenomenon we may have to await a

synthesis of quantum principles and general relativity.

V. V. NARLIKAR.

Benares Hindu University,
August 25, 1941.

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[1] *Phys. Rev.*, 1941, **59**, 708.
[2] *Ibid.*, 1941, **59**, 805.
[3] Frenkel, J., *Wave Machanics (Elementary Theory)*, 1936, **7**.

THE STATIONARY CATHODE SPOT OF A LOW PRESSURE MERCURY ARC DISCHARGE

THE cathode spot of a mercury arc at low pressure wanders about rapidly and irregularly over the surface of the mercury pool. It has been found possible, however, to anchor this spot on a metal part, partly dipped in the pool.[1] We have studied some characteristics of the low pressure mercury arc with an anchored cathode spot.

The mercury arc was struck in a spherical pyrex glass bulb with a cylindrical iron anode and a mercury pool which served as the cathode. A nickel rod, slightly projected over the surface of mercury, was fixed at the bottom of the bulb. It is observed that on striking the arc the cathode spot races round and round over the pool, but after a time attaches itself to the nickel rod and becomes stationary. With the increase in the arc current the spot grows larger in size and encircles greater portion of the rod till it completely surrounds it. If the spot is detached from the rod, it starts dancing over the mercury surface again as the arc current exceeds a critical value and now the rod is as much favoured by it as any other point on the pool. A linear relation is found to exist between the critical current and the diameter of the rod. The current at which the spot completely surrounds the rod is always found to be a fraction of the critical current and for all currents below this critical value the spot remains permanently stationary at the common boundary of nickel and mercury. Moreover, the critical current is found to be independent of the distance between the cathode and the anode.

It is also observed that the cathode spot can be split up into two parts by using two nickel wires partly dipped in mercury. The two wires are kept in contact with each other at the time of starting the arc and the current is gradually increased till the cathode spot surrounds both the wires. The spot gets divided into two components if the wires are now separated. This division of the spot does not take place, however, if the wires are kept apart before the arc is on. In that case the two wires behave independently and the critical current for either is not influenced by the presence of the other. On the other hand, when the spot is split into two components, the arc current can be safely increased to a value equal to the algebraic sum of the critical currents of the two wires. With further increase of current the spots leave the wires and recombine into one which starts racing over the mercury pool as before.

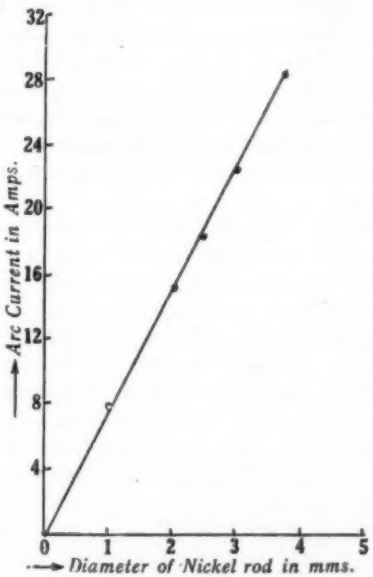

FIG. 1

Fig. 1 shows the linear relation between the

critical arc current and the diameter of the nickel rod partly immersed in mercury.

The details of the experiment will be published elsewhere.

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ABDUL QADIR KHAN.

Department of Physics,
Muslim University, Aligarh,
August 9, 1941.

[1] N. Warmoltz, *Physica*, 1940, **7**, 209.

MIXED SOLVENTS FOR SOAPS

IT is a peculiar fact that alkali metal soaps of palmitic acid, stearic acid, etc., are only sparingly soluble in most organic solvents and so far no good organic solvents for them have been discovered though a large amount of study is being made in connection with the relationship of soaps with organic solvents.[1] This fact has precluded a study of various aspects of soap solutions in organic solvents, which would have been highly useful since soap stands unique as being an organophilic compound of well-known chemical structure. It has however been found out in this laboratory that suitable mixtures of organic solvents have powerful dissolving action on the alkali metal soaps, though the individual components are practically non-solvents for the same.

Detailed studies of such enhanced solvency are under progress and the results will be published elsewhere. It has been observed that any mixture of a monohydric alcohol and a polyhydric alcohol has a powerful solvent action on soaps, though they are individually practically non-solvents at ordinary temperature. There is an optimum solvent composition, where the solubility is maximum and this happens for ethylene glycol ethyl alcohol mixture at about 65 : 45 composition by weight for sodium stearate.

For the same glycol, it appears that the higher the molecular weight of the alcohol, the more is the solvent power, which has been found out by experiments with aliphatic alcohols upto amyl alcohols. For the same alcohol, of the five polyhydric alcohols tested, the efficiency is in the order shown in Table I. By combining suitable mixtures of these latent solvents in appropriate proportions, more than ten per cent. concentrations can be produced at room temperature, and practically any concentration from a thin fluid to transparent gels at temperatures higher than 40° C.

Hydrocarbons have been found to have a peculiar coupler action on these solvent mixtures. Though they are neither themselves solvents for soap, nor have they any perceptible latent solvent activity in combination with any of these aforementioned solvents, in combination with A-G mixtures (alcohol-glycol mixtures), they bring into play a profound solvent action even at room temperature or lower. Suitable A-G-H mixtures (alcohol-glycol-hydrocarbon) have been found, which rapidly dissolve soap at room temperature to almost any concentration not even tending to saturation till production of transparent gel. All the four types of hydrocarbons (aliphatic, cycloparaffins, benzenoid and terpenic) have been found to possess this coupler action to a more or less degree. The following table lists the 'latent solvents' and 'couplers' so far investigated in order of their solvent power. Naturally a week solvent power can be counteracted by using powerful complimentary latent solvents and couplers. For example, glycerol may be turned into a powerful solvent for soap in mixture with iso-butyl alcohol coupled by small quantities of benzene.

TABLE I

Latent Solvents		Couplers
Monohydric Alcohols	Polyhydric Alcohols	Hydrocarbons
iso—Butyl alcohol	Ethylene glycol	Benzene
iso—Amyl alcohol	Propylene glycol	Turpentine
n—Propyl alcohol	Di-ethylene glycol	Cyclohexane
Ethyl alcohol	Glycerol	Heptane
Methyl alcohol	Trimethylene glycol	Hexane

Gels are very easily produced by cooling any such strong solution of a soap in A-G or A-G-H mixture below saturation temperature. These gels are elastic, and transparent to translucent depending on the nature of the solvent mixture, and they show reversible sol-gel transformation, perhaps like other soap gels in organic solvents.[2] It will certainly be of interest to study such transparent soap gels from the standpoint of synerisis, solvation, swelling, etc.

These solutions offer interesting study about their molecular nature, particularly since it is known that though aqueous solutions of soaps are colloidal electrolytes, alcoholic solutions are non-colloidal and of very weak electrolytic nature.[3] So far preliminary experiments on electrical conductivity and ultrafiltration show that these solutions are perhaps truly molecular. The question whether such molecular solutions form gel on increase of concentration or lowering of temperature through reversible association to form micelles, or if such elastic gels are really single-phasic molecular systems, is only to be decided by later experiments, in which the observation recorded herein will certainly be helpful as offering an easy way of producing such solutions and gels of a well-known group of chemical individuals over a wide range of concentration and temperature.

S. R. Palit.

Indian Lac Research Institute,
Namkum, Ranchi,
September 11, 1941.

[1] Vold, Legett and McBain, *J. Phys. Chem.*, 1940, **44**, 1058; Ledrer's *Kolloid chemie der seife*, 1932; other references in these publications.

[2] Banerji and Ghosh, *Zeits. Anorg. u. Allgem. Chem.*, 1930, **194**, 304.

[3] Krafft, *Ber.*, 1899, **32**, 1584; Laing McBain, *J. Chem. Soc.*, 1918, **113**, 435.

A NOTE ON THE PRODUCTION OF COLOURING MATTERS FROM CERTAIN INDIAN LICHENS

Many species of lichens have been employed from the earliest times for the production of dyestuffs such as archil or orchil which contain the colouring matter known as orcein and directly applied in dyeing brown and buff colours on animal fibres such as wool and silk. Among these the species of Roccella and Lecanora have ranked among the foremost. By a modification of the process adopted for the preparation of orchil, the colouring matters contained in the commercial litmus are also obtained.

The lichen, *Roccella montagnei*, which occurs abundantly in Waltair, has been thoroughly investigated in these laboratories and found to have varying combinations of its constituents in different samples, as indicated below:[1]

(*i*) Erythrin and erythritol besides small quantities of free orcinol.

(*ii*) Lecanoric acid, erythritol and roccellic acid besides small quantities of free orcinol.

(*iii*) Montagnetol, orcinol, erythritol and roccellic acid.

(*iv*) Erythrin, montagnetol, orcinol, erythritol and roccellic acid.

It has now been found that the newly discovered compound, montagnetol, is a derivative of orcinol and the lichen thus appeared to be a promising source of orcinol, being rich in orcinol compounds (*viz.*, erythrin, lecanoric acid and montagnetol). Though several species of the genus *Parmelia* have been examined by chemists none of them seems to be included in the category of 'true orchils'. During the course of an examination of the lichen *Parmelia abessinica*, which occurs abundantly in the Bellary and Cuddapah districts of South India, it was found that the lichen contains lecanoric acid 3·3 per cent. and atranorin 1·1 per cent. besides small quantities of other compounds, the high lecanoric acid content indicating an equally high content of orcinol.

It was therefore considered desirable to investigate the utility of the above two lichens for the preparation of the colouring matters. Using the well-known standard methods, with slight alterations in the experimental technique, samples of orchil and azolitmin have been prepared from both the lichens. Detailed tests carried out indicated that the purified samples

of azolitmin obtained from the two sources were as sensitive and useful as an indicator as a pure sample of azolitmin (Merck). An estimation of the orcinol content of the two lichens by the Reymann method gave the following values:

Roccella montagnei	3·4 per cent.
Parmelia abessinica	3·1 per cent.

In view of the fact that these lichens occur so abundantly and the orcinol content of each is high, there appears to be a large scope for utilising them in the production of orcinol.

The authors wish to express their thanks to Prof. T. R. Seshadri for his kind interest in this piece of work.

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Andhra University, Waltair,
August 26, 1941.

[1] Rao and Seshadri, *Proc. Ind. Acad. Sci.*, 1940, **12 A**, 466; 1941, **14**, 199.

COLORIMETRIC ESTIMATION OF PHOSPHORUS IN SOILS

RECENTLY in connection with some work on soils, where a large number of soils had to be examined periodically for phosphorus content, the need for a rapid and accurate method necessitated the re-examination of the colorimetric methods.

Several workers have used stannous chloride, hydroquinone, 1 : 2 : 4 amino-naphthol sulphonic acid, in the colorimetric estimation of phosphorus in soils. It was observed by various investigators, that silica and iron interfered in the normal colour development and modifications and improvements were suggested from time to time. Warren and Pugh[1] have given certain suggestions to eliminate the interference by organic matter and iron, but these have been found difficult and tedious and reliable and reproducible results could not be obtained by other workers.[2,3]

A simple procedure which gives accurate and quick results with a variety of Indian soils has been developed; the method is described below.

10 gm. of soil are digested with 1 : 1 HCl : HNO_3 mixture for about 6 hours at 100° C. with frequent shaking. As a condenser a funnel containing a glass bead in the neck is placed over the flask. The whole of the extract is filtered, washed, and made up to volume (250 c.c.). 10 c.c. aliquot in a test tube (220 mm.×11 mm.) is treated with 1 to 2 gms. or more of sodium bisulphite and boiled vigorously until the solution becomes colourless and water clear. The solution is then cooled, diluted to 50 c.c. after transference with washing into a 100 c.c. volumetric flask or stoppered cylinder. It is then treated with NH_4OH until a haziness (white) develops which settles to a dirty white coagulum on standing. At this point it is immediately neutralised with a few drops of H_2SO_4 (20%). 10 c.c. of ammonium molybdate in 5N H_2SO_4[4] are then added immediately followed by 5 c.c. of 1 : 2 : 4 aminonapthol sulphonic acid reagent (0·25 gms. dissolved in 100 c.c. of 15% $NaHSO_3$ and a few drops of 20% Na_2SO_3). The contents of the flask are then mixed and made up to 100 c.c. 15 minutes allowed for full development of colour and solution compared against a standard.

For citric acid extracts we suggest the following procedure. Suitable aliquots (100–250 c.c.) are concentrated to a syrup in a 250 c.c. kjeldahl flask, treated with 1–2 c.c. of H_2SO_4 (conc.) followed soon after by 2 to 3 c.c. of HNO_3 (conc.) to oxidise the organic matter. Digestion of the organic material is over in about 5 minutes. A further five minutes are allowed for removal of nitrate fumes. After cooling, 10 c.c. of water are added and the flask again heated to boiling; this removes the last traces of nitric fumes. Filter, wash and make up to 50 c.c. Take aliquots and proceed as described above.

During the course of our work it was found that upto 5,000 p.p.m. of Fe''' had no effect on

the colour developed. Full details will be published elsewhere.

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Agricultural Chemistry,
Imperial Agricultural Research
Institute, New Delhi,
September 27, 1941.

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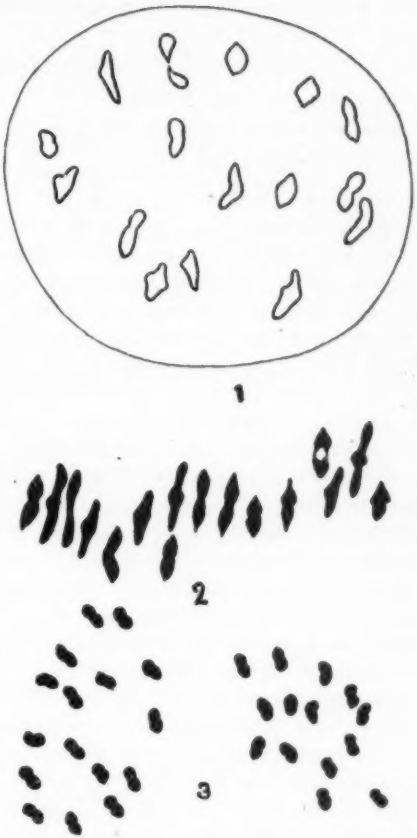
[1] Warren and Pugh, *J. Agric. Sci.*, 1930, **20**, 532.
[2] Ian Armstrong Black, *Soil Sci.*, April 1941.
[3] D. K. Patel, "Thesis Associateship I. A. R. I.," Private communication.
[4] Fiske and Subbarow, *J. Biol. Chem.*, 1925, **66**, 375.

CHROMOSOME NUMBER OF *SESAMUM PROSTRATUM* RETZ.

THE genus *Sesamum* which includes our cultivated *til*, *S. orientale* L. (= *S. indicum* L.) is also represented in India by two wild species, *viz.*, S. *laciniatum* Klein and *S. prostratum*. While the chromosome number of the cultivated species has been reported by several authors[1,2,4] as $n = 13$, that of the wild species has not so far been recorded. This note records the chromosome number of *S. prostratum*.

Seeds of this species were obtained through the courtesy of Rao Bahadur G. N. Rangaswami Ayyangar, Millets Specialist, Coimbatore, and plants raised at the Imperial Agricultural Research Institute, New Delhi. The plants are prostrate with trailing branches, thick orbicular leaves, purple flowers and black seeds; they are remarkably free from the attack of diseases and pests to which the cultivated species is generally susceptible. Pollen meiosis in these plants was studied in acetocarmine smears. Figs. 1, 2 and 3 represent late diakinesis, metaphase I and metaphase II respectively which clearly show that the gametic chromosome number of the species is 16.



In a recent note John and Narasinga Rao[3] reported the somatic chromosome number of an Argentine species, *S. radiatum* Schum. and Thonn. as 64. It is interesting to notice that the Indian wild species, *S. prostratum* with $2n = 32$ chromosomes bring out the existence of a polyploid series in the genus. Although it is not possible, with the data regarding chromosome numbers at present available, to postulate a basic number for the genus, it is obvious that *S. orientale* with $2n = 26$ does not fit into the scale of polyploidy as revealed by the chromosome numbers of the wild Indian and Argentine species. The origin of the cultivated species with the 'heteroploid' number of chromosomes and the possible utility

of the wild species for breeding superior forms of *til* are under investigation.

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Section of Economic Botany,
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New Delhi,
October 2, 1941.

[1] Morinaga, T., Fukushima, E., Kano, T., Maruyama, Y., and Yamasaki, Y., *Bot. Mag., Tokyo*, 1929, **43**, 512.

[2] Nohara, S., *Jour. Coll. Agri. Tokyo, Imp. Univ.*, 1934, **13**, 9.

[3] John, C. M., and Narasinga Rao, U., *Curr. Sci.*, 1941, **10**, 364.

[4] Richaria, R. H., and Persai, D. P., *Ibid.*, 1940, **9**, 542.

TRICOTYLEDONY IN *MORUS MULTICAULIS* PERR.

TRICOTYLEDONY is a phenomenon, sometimes reported in some genera of the dicotyledonous angiosperms.

Buonocore[1] first reported tricotyledonous seedlings in *M. alba* and stated that it was not possible to determine which external character or hereditary (genetical) character was responsible for its appearance.

The present writer found one tricotyledonous seedling of the variety *Roso* of *Morus multicaulis* in a seed-bed this year.

The normal pair of cotyledons are of equal size, opposite to each other and measure 11 mm. in length each. They are borne on the hypocotyl and have prominent veins. The third cotyledon originates from a point a little higher and a little smaller (4 mm. in length) (Fig. 1).

Due to the rarity of these specimens it is proposed to search for more materials the next season, when the true interpretation of such a phenomenon will be discussed in a subsequent paper in the light of various theories put forward by competent authorities.

In conclusion, the writer wishes to convey his sincere thanks to Mr. S. C. Mitter, Director of Industries, and Mr. C. C. Ghosh, Deputy Director of Sericulture, Bengal, for their encouragement and to Dr. S. P. Agharkar, Head of the Department of Botany, Calcutta University, for his helpful suggestions and criticisms.

FIG. 1

Tricotyledonous seedling of *Morus multicaulis* var. *Roso*. C. denotes the normal pair of cotyledons. C', denotes the third cotyledon. × 4.

R. M. DATTA.

Sericultural Research Station,
Narayanpur Colony, Dum Dum,
August 12, 1941.

[1] Buonocore, C., Fenomeni teratologici in *Morus alba* L. Anomalie dell' apparato sessuale, *Boll. d, R. Staz. di Gelsicolt e Bachicolt di Ascoli, Piceno*, 1938, **17**, n. 3–4, 17–18.

THE GAS-BLADDER OF THE GOBIOID FISH *BOLEOPHTHALMUS BODDARTI* (PALLAS)*

IN dealing with the modifications of swim-bladder in certain air-breathing fishes of India, Hora[1] stated that "*Periophthalmodon*, *Periophthalmus* and *Boleophthalmus* are almost terrestrial in their habits and possess well-developed cheek pouches for the storage of air.

* Published with the permission of the Additional Revenue Secretary (Rural Reconstruction), H. E. H. the Nizam's Government, Hyderabad (Dn.).

The air-bladder is absent in these genera." It is, however, very interesting to note that though the habits and habitats of *Boleophthalmus boddarti* (Pallas) are more or less similar to those of *Periophthalmus*, a small gas-bladder in *Boleophthalmus* is associated with its more pronounced terrestrial mode of life.

The gas-bladder in *B. boddarti* is a small, ovoid or ellipsoidal structure, lying freely in the body cavity of the fish above the alimentary canal, and is supported by the mesentery (Text-fig. 1). It has no pneumatic duct, i.e., it is of a physoclistous type.

A star-shaped gas-gland with five retia mirabilia is present on the anterior end of the gas-bladder (Text-fig. 2), very much resembling that of *Peristethus catapharactus* (*Peristedion cataphractum* C.V.), one of the Triglidæ, described by Woodland, the only difference being that the retia mirabilia in *Peristethus* are ten in number. The 'red-body' in *Boleophthalmus* is star-shaped, owing to the fact that the artery and vein supplying the glandular epithelium, when arriving at the centre of the star-shaped 'red-body' break up each into five vessels. Each rete mirabile supplies a portion of the glandular epithelium.

FIG. 1

FIG. 2

FIG. 3

Showing the position of the gas-bladder (Gs. bl.) and retia mirabilia (R. M.) *in situ* in *Boleophthalmus boddarti* (Pall.). ×⅔. Anterior portion of the gas-bladder, showing the disposition of the retia mirabilia (R. M.). × 1⅓. Camera lucida drawing of a transverse section passing through the anterior portion of the gas-bladder (Gs. bl.), showing two retia mirabilia (R. M.) cut across, the bladder-epithelium (B. W.) and the gas-gland epithelium (G. E.).

The histology of the gas-gland of this fish is very interesting and presents the following characteristic features:

(1) The epithelium of the gas-gland is not folded and is only one to two-cell thick and encloses erythrocytes (Text-fig. 3, G.E.).

(2) The bladder-epithelium (B.W.) is usually one-cell thick and no erythrocytes are found in it.

(3) Taking a small portion of the anterior region of the gas-bladder wall it is seen that usually two retia mirabilia (R.M.) are cut across in a transverse section, each of which is divided up into innumerable minute, extremely thin-walled compartments, or, in other words, really consist of a bunch of extremely fine blood-capillaries, the lumen of each of which contains one or two erythrocytes.

I wish to express my great indebtedness to Prof. S. G. Manavala Ramanujam for all the help and facilities he gave me while I was working on this fish in his laboratory at Madras. I am very thankful to Dr. S. L. Hora for the correct name of this fish. My thanks are also due to Prof. B. K. Das for some useful suggestions.

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September 17, 1941.

[1] *Curr. Sci.*, 1935, **3**, 336.

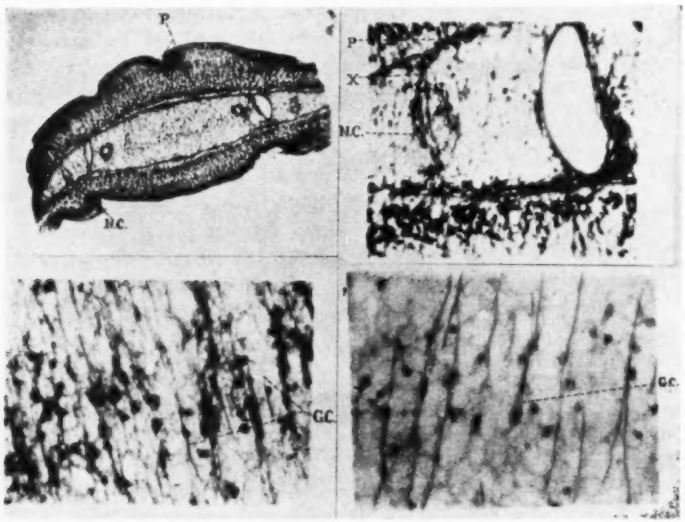
SYMPATHETIC INNERVATION OF PROGLOTTIDES IN *AVITELLINA LAHOREA* WOODLAND

IN a recent paper[1] I raised the question as to how a proglottid is able to live and move after having become detached from the proglottid chain? Rietchel[2] from a study of the physiology of successive co-ordinated contraction waves in *Catenotænia* comes to the conclusion that the stimulus producing contractions

is not dependent on the brain since it can arise in any proglottid. His interpretation is that the wave is myogenic and is transmitted mechanically in a backward direction through the tension of the contracting muscle fibres.

It is a well-known fact that in Tetraphyllids ripening of germ cells takes place after the proglottides have become free. Is there any nervous mechanism in such proglottides co-ordinating the activities of the various organs? A plexus has been observed in proglottides by Blochmann,[3] Zernecke[4] and myself.[1,5] In vertebrates there is a dense plexus of nerve fibrils in different tissues of the body (Boeke[6]) which plays a fundamental rôle in the maintenance of metabolism. Some interesting results have been obtained with the Bielchowsky technique in *Avitellina lahorea* Woodland which seem to suggest that the plexus in the proglottides is comparable to the sympathetic plexus of vertebrates.

The material was very refractory and after about 150 experiments some very good impregnations were obtained. But even in these slides the muscle fibres are black. A similar blackening of muscle fibres in *Ligula* after chrome silver method is recorded by Blochmann.[3] In lightly impregnated slides showing typical sense cells, the muscles are yellow, but they go black when toned with gold chloride. To get a clear idea of the arrangement of the nerves and nerve fibrils we have to turn to cross-sections. Photomicrograph 1 is a transverse section of an immature proglottid. Outside the excretory vessels are the two nerve cords running the length of the proglottid chain. In all Taenia, according to Cohn,[7] there should be ten nerves running throughout the chain of segments. In *Avitellina* immature and mature segments show only two longitudinal cords. In Flemming and Zenker fixed material, the transverse sections of the longitudinal cords show nuclei on their external border. Often these nuclei completely encircle the cord.



1. Transverse section showing the two nerve cords, the two plexuses and the ganglion cells in the medullary parenchyma. Bielchowsky. × 15.

2. Transverse section showing bundle of nerve fibrils from the nerve cord running into the plexus. Bielchowsky. × 102–5.

3. Ganglion cells in the medullary parenchyma. Bielchowsky. × 147–5.

4. Ganglion cells, Cajal. × 175.

G. C.–Nerve cells, N. C.–Nerve cord; P. Plexus X.–Bundle; of nerve fibres from the nerve cord entering the plexus.

But even in such instances a semi-lunar area on the outer margin appears studded with nuclei. Bielchowsky preparations present an entirely different appearance (Photo 3). What strikes one in a transverse section is the scattered ganglion cells in the medullary parenchyma as recorded previously for *Ligula* by Zernecke[4] (Photos 3 and 4). Some are bipolar and others multipolar. The cell is dark in well-impregnated Bielchowsky preparations, and the nucleus could not be differentiated from the cytoplasm. In material treated with 2% silver nitrate, without previous fixation, the nuclei of these ganglion cells are very clear and show a nucleolus (Photo 4). The cell bodies and fibrils in such cells are only lightly impregnated. In Flemming and Zenker sections carefully stained in iron hæmatoxylin the nuclei of the neurones could easily be differentiated from others.

Just below the bundles of longitudinal muscles on the dorsal and ventral sides is a plexus of nerve fibrils having the shape of a low arch (Photo 1). The fibrils from the ganglion cells in the medulla either end on this or often cross it to end on the cuticle. Bipolar and multipolar nerve cells are found in this plexus. Usually in these plexuses there is a concentration of ganglion cells in the centre which sometimes juts into the medulla as a knob (Photo 1).

The most interesting observation is that the main nerve cords do not send nerve branches to any of the organs. It is true that nerve fibrils could be seen leaving the nerve cord in various directions but such fibrils are few in number and neither do they go to all the organs. At irregular intervals bundles of fibrils leave the main cords, enter and get mingled with the fibrils of the plexus (Photo 2). The innervation of the various regions of the proglottid seems to be by nerve fibrils from the plexuses. These could be traced to muscle bundles and bundles of fibrils could be seen passing between the longitudinal muscles towards the cuticle.

From the above description it will be seen that the various organs in the proglottid are mainly innervated by fibrils from the plexus and from the ganglion cells lying free in the medulla. It appears also that the function of the main nerve cords is only co-ordination of the activities of the various proglottides. Therefore it is easy to understand how on detachment from the chain a proglottid is able to live independently. One is reminded in this connection of the well-known experiments of Cannon and co-workers.[8] Cats, whose right and left sympathetic trunks were removed surgically lived in good health when suitably cared for. Though disconnected from the central nervous system the sympathetic plexuses were capable of maintaining the normal working of the organs.

Are we seeing in cestodes a separation of the function into central and sympathetic of the original diffuse network of jellyfishes and other Cœlenterates?

M. K. Subramaniam.

Department of Zoology,
University of Madras,
September 22, 1941.

[1] Subramaniam, M. K., *Rec. Ind. Mus.*, Sept. 1941 (In press).

[2] Rietschel, P. E., *Zool. Anz.*, 1935, **111**, (3/4), 109.

[3] Blochmann von F., *Biol. Zentralbl.*, 1895, **15**, 14.

[4] Zernecke, E., *Zool. Zahrb. Anat.*, 1896, **9**, 91.

[5] Subramaniam, M. K., *Curr. Sci.*, 1940, **9**, 500.

[6] Boeke, J., *Problems of Nervous Anatomy*, Oxford Univ. Press, London, 1940.

[7] Cohn, L., *Zool. Jahrb. Anat.*, 1900, **12**, 89.

[8] Cannon, Newton, Bright, Menkin and Moore, *Amer. J. Physiol.*, 1929, **89**, 84.

A NEW SPECIES OF THE NEMATODE GENUS *BLATTOPHILA* COBB, 1920 FROM A COCKROACH

The author got an opportunity to dissect several specimens of *Supella supellectillum* Serv. One of them was found to be infected with a single specimen of a nematode. On examination the worm was found to resemble closely *Blattophila sphaerolaima* Cobb, 1920. But the differences between the two appear to be sufficient enough to regard it as a new species of the genus *Blattophila* Cobb, 1920. The name *Blattophila supellaima* is proposed for it.

GENUS BLATTOPHILA COBB, 1920.

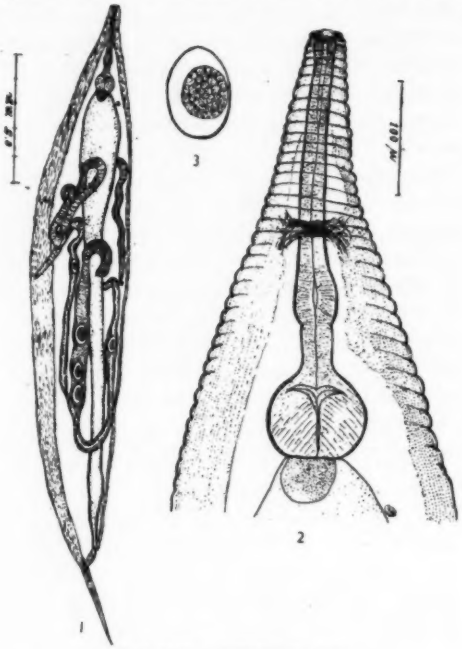
Generic diagnosis.—Thelastomatinæ: "Oral opening surrounded by eight labiopapillæ, amphids represented externally by small round openings at level of labiopapillæ. Lateral alæ absent. Buccal cavity short and wide, partially surrounded by anterior end of œsophagus and having at base six cuticular thickenings serving as points of attachment for muscles. Œsophagus consists of (1) a clavate corpus distinctly enlarged at anterior end in form of a sub-spherical swelling, and (1a) a posterior part slightly swollen but not set off, (2) a short narrow isthmus, and (3) a bulb. Excretory pore posterior to base of œsophagus. Intestine dilated at anterior end; cæcum absent. Tail of male truncate, conical, bearing two large pre-anal submedian papillæ adjoining anus, and two similar post-anal papillæ, one-third of a body diameter, posterior to anus. Spicule represented by a rudimentary point. Tail of female filiform and spine-like. Vulva anterior to middle of body. Eggs ellipsoidal."

BLATTOPHILA SUPELLAIMA, sp. nov. (Figs. 1 to 3)

Specific description.—Blattophila:

Male unknown.

Female: 2·5 mm. long by 360 μ wide. Cuticle annulated; annules about 10 μ wide near the head and 15 to 20 μ wide at the mid-region of body. Buccal cavity short and wide, partially surrounded by the anterior end of œsophagus, 10 μ deep by 12 μ wide. Œsophagus 387 μ long, cephalic swelling of œsophagus 15 μ long by 20 μ wide, corpus 262 μ long with a minimum diameter of 17 μ and a maximum diameter of 40 μ which represents the posterior swelling; isthmus 40 μ long by 27 μ wide; bulb 85 μ long by 90 μ wide. Nerve ring 175 μ from the anterior end of body. Excretory pore posterior to base of œsophagus, 455 μ from the anterior end of body. Intestine thick-walled with a distinct dilated cardia. Anus 380 μ from posterior end of body. Tail filiform. Vulva 1·02 mm. from anterior end of body, about 41 per cent. of the body length from the anterior end. Ovaries two, both anterior, directed posteriorly and reflexed anteriorly. Vagina directed anteriorly, true vagina cuticularly lined, about 100 μ long, communicating with the single uterus which runs straight backwards to a length of about 700 μ where it meets the two oviducts, one of which is directed anteriorly, the other is directed posteriorly for about



Blattophila supellaima sp. nov.

FIG. 1.—Adult female, latero-ventral view.
2.—Female, œsophageal region.
3.—Egg.

100 μ, then becomes reflexed and runs anteriorly parallel to the first oviduct. Both the oviducts meet the ovaries at about one-third of the body length from the anterior end. The ovaries get reflexed at about 270 μ posterior to base of œsophagus, and become directed posteriorly. They originate somewhere near the region of the vulva. Eggs ellipsoidal, 80 μ long by 60 μ wide.

Host.—Supella supellectillum Serv.

Location.—Intestine (rectum).

Type locality.—Aligarh (North India).

Type specimen.—Museum of the Zoological Laboratories, Muslim University, Aligarh; Helminthological collection No. 1023.

The Genus *Blattophila* Cobb was, up to this time, represented only by a single species,

Blattophila sphærolaima Cobb. Chitwood (1934) has described a nematode from *Panesthia javanica* which closely agrees with the description given by Cobb for *Blattophila sphærolaima*; but because of the very few differences between the two, Chitwood did not think himself justified to create a new species for his worm. He has described it as representing a new variety of Cobb's species. The worm described in this paper differs from both of them in the following characters: (*a*) The vulva is relatively much farther posterior than in both the previously described specimens (41 per cent. of the body length from the anterior end of body as against 28 per cent. in Cobb's specimens and 21 to 23·6 per cent. in Chitwood's specimens); (b) the vagina is directed anteriorly as against that of Cobb's and Chitwood's species where it is described as directed posteriorly; (c) the tail is comparatively much smaller in length (15·2 per cent. of the body length as against 23·6 per cent. in Chitwood's specimens). The writer considers these differences sufficient enough for the erection of a new species.

M. A. Basir.

Department of Zoology,
Muslim University, Aligarh,
September 9, 1941.

Basir, M. A., *Proc. Ind. Acad. Sci.*, **1940** (B), No. 1, 8; *Ibid.*, **1941**, (B), No. 3, 163.
baylis, H. A., and Daubney, R., *Brit. Mus.* (*Nat. Hist.*), **1926**.
Chitwood, B. G., *Zeit. Parasitenk*, **1932**, **5**, 1, 14.
—, and Chitwood, M. B., *The Philippine Journal of Science*, **1934**, **52**, 4, 381.
Christie, J. R., *Jour. Agr. Res.*, **1931**, **42**, 463.
Hammerschmidt, K. E., *Abhanda. Wien.*, **1846–47**, **1**, 279.
Travasses, L., *Int. Oswaldo Cruz. Suppl.*, **1929**, **5**, 15.

AN INTERESTING CASE OF MIGRATION OF THE STONE-LICKING FISH, *GARRA MULLYA* (SYKES), FOR BREEDING

On the 23rd March 1941, while making a collection of fishes in the upper reaches of the Kallar Stream, about 4 miles above Mondieruma-thozhu bridge in the Pampadamparа-Kombai bridle-path, Peerumedu Taluk, Travancore, the present writer observed shoals of *Garra mullya* (Sykes) dashing upstream over a fairly steep slippery rock where the water had spread out to a depth of hardly more than an inch. The sight was remarkable since it was a mad rush on the part of the fish, prompted by some irresistible force, to reach the pool above where there was a gentle flow of water. Enormous numbers of fish had collected together below the rock and were moving upwards in a body. At one dart they would traverse 1 to 2 feet over the rocky surface against the swift current and would attach themselves to the rocks firmly with the aid of their suckers and the paired fins, resting for a few seconds before attempting the next move. The water was hardly sufficient to cover the fish and wherever they attached themselves, the water arched over them due to the obstruction caused. One or two small depressions on the rock served as convenient resting places during the upward journey. Whenever a fish failed to effect a firm grasp by the aid of the sucker, it was carried down for a considerable distance. The fish chose the path of least resistance, as was evident from the fact that on one side of the stream, where the fall of the water was abrupt and vertical, no migratory activity was witnessed, whereas on the opposite side, where the gradient was lower, the activity was at its maximum. An estimate of the large numbers present can be made from the fact that over 40 lbs. of migrating fish, about 5 to 8 inches in length, were collected from a small side channel 10 yards long, 1 to 3 feet wide and a few inches deep by blocking it above and below.

The presence of people in close proximity did not materially disturb the fish in their migratory activities. Some of the coolies who accompanied the writer and who could hardly be dissuaded from the temptation of making as rich a harvest as possible, stationed themselves midway with sticks and knives and picked up the fish one by one as they ascended.

It is not possible to say when the activity had started and when it would have ended. It was noticed at 2 p.m. and the writer could not remain on the spot for more than 3 hours.

All this time the migration continued unceasingly. The local hill tribes, Mannans and Palikans, on being asked about this told the writer that such activities have been noticed by them, but they were not in a position to give any information as to the exact season and duration. This particular case observed by the writer does not seem to have any relation to rains, as no rainfall had been recorded in this area for over 2 months.

All the migrating fish were adults and they were so full of ova and milt that these streamed out profusely even when the fish were very gently handled. The females were relatively larger in size and more in number than the males. One medium-sized specimen measuring 6 inches contained 3,834 well-developed eggs. The early development is exactly like that of the Ceylon form, *Garra ceylonensis ceylonensis* (Bleeker) described by the writer in 1938.[1]

Migratory breeding activity is well known in Cyprinid fishes. As regards *Garra*, Dr. S. L. Hora informs me that a photograph of migrating fish of this genus was published in some popular journal in 1920, though he has not been able to locate it. It would be helpful if any of the readers of this note could kindly give the reference.[2] Dr. Hora has referred to the mass movement of these fishes in the *Records of the Indian Museum*, 1921, *22*, 637.

Garra mullya (Sykes) is very common in the hill-streams of Travancore; it is called locally *Kallalotti*, *Kallilotti*, *Kallotti* and *Kallamutti*, referring to its habit of adhering to stones. It grows to a length of nearly 8 inches and is eaten by people resident in the hills, though not so much relished as some of the larger Cyprinids.

S. Jones.

Central Research Institute,
University of Travancore,
Trivandrum,
August 1, 1941.

[1] S Jones, *Ceylon Journ. Sci.*, 1938, **6**, 91.

[2] Dr. Hora thinks that the photograph referred to above may have appeared in the *Times of London, Illustrated Weekly*.

AN INDIAN SOURCE FOR COLCHICINE

The use of Colchicine for inducing polyploidy is now well known to plant-breeders. Clewer, Green and Tutin (1915) have chemically analysed the alcoholic extract from the tubers of *Gloriosa superba* L.* (N.O. Liliacea) and found that in addition to other chemical compounds, it contains the alkaloid Colchicine to the extent of 0·3% of the dry weight of the tubers, as against 0·35 to 0·4% in *Colchicum autumnale* L. *Colchicum autumnale* L. is not a native of India but has a distribution in the temperate region round-about the Mediterranean and Central Asia. The only allied species found in India is *Colchicum luteum* growing on the grassy slopes of the Western Himalaya.

The cost of the pure alkaloid is about Rs. 10 per gram and of the crude product Colchicum corn or seed powder is about Rs. 5 per lb. In view of the wide distribution in India and Ceylon of this weed *Gloriosa superba* L. and the great cost of the imported drug, it is suggested that attention may well be directed to the exploitation of this Indian weed for obtaining the valuable alkaloid.

In a preliminary experiment in these laboratories, maize seeds were treated with an extract of *Gloriosa superba* and sown. The developing roots showed tetraploid sectors—a result very similar to the effects of treatment with aqueous solution of Colchicine.

N. Parthasarathy.

Imperial Sugarcane Station,
Coimbatore,
October 4, 1941.

[1] Clever, H. W. B., Green, S. J., Tutin, F., *Jour. Chem. Soc. Trans.*, 1915, **107**, 835.

[2] Martindale and Westcott, *The extra Pharmacopœia*, 1932, 20th Edition.

* Vernacular names of *Gloriosa superba* L.
Hind. Karihari; *Ur.* Meheria-phulo, Agni-sikha; *Tel.* Adivi-nabhi, Kalappa-gadda, Potti-dumpa, Ganjeri; *Tam* Kela-paik-kilangu, Kannuvelli; *Mal.* Mettonni

REVIEWS

The Birth and Death of the Sun. By George Gamow. (Macmillan and Co., Ltd., London), 1941. Pp. xiv + 232. Price 12*sh.* 6*d.* net.

Of the various problems of modern astronomy, the one concerning stellar structure is perhaps the most interesting from the point of view of the scientific minded layman. The subject itself is but of recent development. Although the problem has attracted the attention of philosophers from the earliest times, the prevalent ideas about the internal constitution and the evolution of stars were for a long time mostly speculative, and even in the beginning of the nineteenth century, it is said, Herschel imagined the sun to be a hot globe of vast dimensions with possibly a cool interior core that may be habitable. The fundamental researches of Lane, Kelvin, Ritter, Emden and Schwarzchild, to mention the names of only a few of the pioneers, laid the foundation for many of the subsequent investigations on the mechanism by which the sun's light and heat are maintained; and it is to be noted that the recent progress in nuclear physics has to a large extent, contributed to the important advances made during the last two decades.

In the present book with the attractive title "The Birth and Death of the Sun", Prof. Gamow has given a clear exposition of the present knowledge of the problem of 'Stars in action' in a manner suitable to the general reader who takes an intelligent interest in current scientific thought. The book is authoritative and written in a fascinating style; and the treatment is none too technical. Mathematical formulæ are avoided and all important results are explained in simple non-technical language. The illustrations are excellent and the diagrams —many of them drawn by the author in his inimitable style—clearly illustrate the argument and add much to the interest of the work.

The book opens with a chapter on the 'Sun and its Energy', in which, after some preliminary explanation, we have a discussion of the problem of the age of the sun, and the source of the tremendously large output of energy radiating from it. Chapters II–IV deal with a variety of topics in physics, required for an understanding of the latter parts of the book, and contain an account of such subjects as the structure of the atom, the problem of the atomic nucleus, radio activity, the transmutation of elements and the liberation of sub-atomic energy. The application of the results of these discoveries to investigations of energy generation in the sun is treated in the next chapter, where we find a description of Bethe's work on the cyclic chain of nuclear reactions. Chapter VI contains a brief survey of some of the principal facts of astrophysics —the theory of giant and dwarf stars first formulated by Russell, and the Mass-Luminosity relation discovered by Eddington. The abnormal stars—the red giants and the white dwarfs—are considered in the next two chapters and an attempt has been made to deduce the life-history of the sun—its initial and final stages by considerations of analogy with these classes of objects. It will be of interest to readers in India to note the references made to the important contributions of Chandrasekhar and Kothari to the study of the collapsed state of stellar bodies. The characteristics of novæ and supernovæ are dealt with in Chapter IX and the last three chapters contain brief discussions of a number of cosmological topics—the formation of stars and planets, the galactic system, its structure and rotation, the extra galactic nebulæ and their enormous velocities of recession. The book concludes with a short resume of the current ideas of stellar evolution in the light of the facts that have become available from recent researches.

There is an atmosphere of pleasant humour throughout the exposition which makes even the difficult parts of the book delightful reading, and, here and there short anecdotes are related which add to the interest. The book will, no doubt, have a

very important place in the popular literature on astrophysics. T. P. B.

General Bacteriology. By D. B. Swingle, (Chapman and Hall, London), 1940. Pp. xii + 313. Price 16*sh.* nett.

Many books have been published and are being published on Bacteriology. Some of them are voluminous tomes which try to present all available information, Chemistry, Biology, Genetics, etc. An informative, pleasant book which takes the beginner step by step into the field of Bacteriology without leading him straightaway into the difficulties and ignorance which besets the student when first he tries to learn the subject,—a book which can be placed safely into the hands of a nurse or a student who only learns Bacteriology as a side-show-optional subject, has not been obtainable so far; Dr. Swingle's book goes far to supply this deficiency. Perhaps the book under review is rather ambitious in bringing in chapters on Sewage, Bacteriology of Molds, etc. A Sanitary Engineering student, who has to have a working knowledge of Bacteriology can also well use the Book.

The binding and typography are excellent. Many of the pictures are of pen and ink and give quite vivid pictures of Bacteria; the danger here is that these may leave an impression (which may not be wiped out later) that bacterial structures are simple and the mind may not be open to the more intricate problems of R. and S. Strains, Capsules, Antigenic structure, etc.

The price is not too heavy for a book of this type. ENNE.

University of Calcutta "Anthropological Papers"—New Series, No. 6, 1941. Calcutta University Press.

This periodical publication was started to enable the teachers and senior students of the Department of Anthropology of the University of Calcutta to publish promptly, the results of their investigations. The present issue contains five papers on Social Anthropology, four on Physical Anthropology, and one each on Prehistoric Archæology and Primitive Technology. Prof. Chattopadhyay reviews Khasi Kinship and Social organisation in the light of his recent investigations. Mr. T. C. Das seeks to explain, in an article of great theoretical interest, some ritual rôles of relatives-in-law among the Kuki tribes of Manipur, as relics of matrilocal residence which required a man on his marriage to join the wife's household. In a short paper, Mr. N. K. Bose attempts to date the boulder-conglomerate beds at the paleolithic site at Kuliana in the Mayurbhanj State. The four papers dealing with Physical Anthropology are: (1) Studies in Eyebrows among the Bengalees; (2) Incidence of the Muscle Palmaris Longus among the Marwari Community; (3) The Pterion in Indian Human Crania; (4) Study of the Head-Hair of the Noluas of Bengal.

The long paper on Garo Law of Inheritance by Mr. J. K. Bose is a demonstration of the manner in which anthropology can, even in India, be of practical use to the administrator, as it is in other parts of the world. There is a wrong belief current among the executive and judicial authorities that Hindu law or the laws that apply to the lower castes can be applied to the primitive tribes. But this is a subject that has not been gone into in most parts of tribal India. The administrators who had the wisdom to use the anthropologists, and the anthropologists themselves are to be congratulated on this fruitful co-operation.

This number of "Anthrological Papers" is dedicated to the memory of that brilliant investigator and inspiring teacher, the late Dr. Panchanan Mitra, by his devoted friends of the Calcutta University Department of Anthropology which he did much to build up. A. AIYAPPAN.

Strontium and Phosphate Minerals. *Bulletins of Economic Minerals*—No. 3, Strontium; No. 4. Phosphates. By Dr. M. S. Krishnan. (*Records of the Geological Survey of India,* 1941.) Pp. 76. Price As. 6 and As. 12 respectively.

The Bulletins give an exhaustive account of the mineralogy, occurrence and uses of these industrially important minerals together with technological notes on the preparation, marketing and utilization of the various products obtainable from them.

The chief source for Strontium in India is noted to be from Celestite occurring in the cretaceous rocks of the Trichinopoly District, Madras, where the available quantity of this mineral is expected to be between 500,000 to 1,000,000 tons. As the mineral has been re-discovered only recently, there has been no production so far. Dr. Krishnan points out that the manufacture of Strontium salts being comparatively easy, there is no reason why these salts cannot be prepared locally from Trichinopoly celestite, and used in pyrotechnics, in the paint industry, and for making medicinal preparations. He also points out that celestite of the requisite grades can be ground and used in place of barite in paints and as filler in rubber, lac and other industries.

In the Bulletin on Phosphates, Dr. Krishnan gives a general survey of the resources of all the countries of the world producing the phosphate minerals, together with detailed notes of practical value on prospecting, mining and preparation of the minerals, and the technology of their products and their uses. The important sources available in India are from the apatite deposits of the Singhbhum District, the phosphatic nodules from the Trichinopoly District and also from a bed of phosphate rock at Mussoorie in the United Provinces. The estimated reserves from the two important areas, *viz.*, about 700,000 tons of apatite containing between 20–25% of P_2O_5 in Singhbhum and 8 million tons of nodules containing roughly some 25% of P_2O_5 from Trichinopoly indicate rather poor resources for a vast country like India whose dominant occupation is agriculture, requiring large amounts of manurial products. It is regrettable that even these available sources have not been satisfactorily developed or exploited so far. Dr. Krishnan opines that further work on the utilization of our phosphate minerals may be carried out on the lines of what has been achieved in America by the Tennesse Valley authority. He considers that the Flotation process could probably be used to obtain the requisite concentrated grade from the available raw material and also that the Calcination process has distinctly good possibilities. The fused and the calcined phosphates are low-cost products which have a high manurial value and can well compete with the imported phosphatic manures and therefore, their manufacture locally is well worth consideration.

Another distressing feature in India, to which Dr. Krishnan draws attention, is the export of bones and bone meal from this country which has to import the manufactured phosphatic manures. The country thereby sustains a double loss and this is a matter which ought to receive the earnest consideration of Government and industrialists alike. M. B. R.

Padakatintlo Vignanacharcha (*Bedroom discourses in Science*). By Mr. Vasanta Rao Venkata Rao, Maharaja's College, Vizianagaram, 1941. Pp. 97.

This is a booklet in Telugu treating of some modern scientific ideas in a popular manner, in homely, non-technical language. It is in the form of bedroom discourses by a man of science. The author explains some facts in Astronomy and Physics in an interesting manner, referring, wherever possible, to similar ideas expounded by our ancients. The planetary system, the starry world, the three states of matter, the constitution of the atom, wave motion, electro-magnetic radiation and the X-rays are the subjects dealt with. In an Appendix, some of the more important instruments of observation, such as the telescope, the microscope and the spectroscope are described with the help of diagrams.

Tracts like these should be published in large numbers in our vernaculars with a view to create in our people a taste for Science. B. V.

THE MANURING OF SUGARCANE IN INDIA

A CRITICAL examination and summary of the results of the large number of experiments on the manuring of sugarcane in India mainly with the object of making suitable recommendations on this important aspect of sugarcane cultivation has been carried out by R. D. Rege at the instance of the Imperial Council of Agricultural Research and this has now been published (*Misc. Bulletin No.* 41 *of the I.C.A.R.*). The experiments examined are comparatively recent ones covering the period from 1932–39, as these experiments have been laid out in conformity with the new statistical technique and are deemed more accurate and reliable than those conducted before this period which indeed are very much the more numerous. A brief summary of the results of these earlier experiments is however extracted from the "Analysis of Manurial Experiments in India," published already. A soil map of India is inserted to show the main types on which sugarcane is grown to which results of experiments conducted in the respective soil tracts may be considered more applicable. The broad classification however is between the Gangetic Alluvium tract of Upper India and the quite different type of soils and climate of peninsular India. Coming to the results themselves, farmyard manure is considered first. Applied on the basis of an equal nitrogen content, farmyard manure is inferior to oilcakes and sulphate of ammonia, whether used by themselves or in conjunction with farmyard manure. This is one definite result in the midst of a good deal of indefiniteness which prevails more or less with regard to most other aspects of manuring. Data regarding the residual effect of farmyard manure are conflicting; data regarding its rôle as a 'soil improver' (apparently its physical condition) do not relate to a sufficiently long period. Data are likewise too meagre for deciding the relative value of farmyard manure and compost, apparently both on the basis of equal nitrogen content. Regarding green manuring sannhemp has been the general crop used for this purpose, and on the whole has been found the best. It is stated that the ploughing in of the whole crop is better than ploughing in the above-ground portion alone or the below-ground portion alone, and at the same time that the utilisation of the stems for the extraction of the fibre does not affect the manurial value of the crop, which is rather difficult to understand. Molasses as a fertiliser has also given inconclusive results, being found decidedly good in Upper India and of little value in the south. Upper Indian results make it out to be a very promising material whose use may, with advantage, be encouraged. There are no results of a decisive character regarding the relative values of the different oilcakes on the yield of cane or the quality of the juice. It may however be pointed out that the rates of nitrification of most oilcakes is known and for the rest the price per unit of nitrogen at which the particular cake can be had can decide the choice. A noteworthy and somewhat surprising result is that *mahua* oilcake (the *Ippe* cake of Mysore) has been used as a good manure and that it has been found indeed better than other cakes. The cake has been found in South India to be inert as regards nitrification even for periods of more than two months in the soil and in view of the saponin content it has not been recommended at all.

Coming to the inorganic fertilisers we are told that much of the huge mass of data relate to experiments either defective in design or inadequate in replications. Reference is made to certain very accurate experiments, which indeed have brought out the same conclusions that have been reached long before and have formed almost the basic facts in sugarcane manuring. Thus, the response is certain and striking, increasing progressively only with nitrogenous manuring, the response to phosphatic and potash manuring is negligible, the latter indeed has a depressing effect. This was in the Punjab. Likewise in Patna it was found that potash was not necessary. Potash with Niciphos in fact depressed the yield. The rôle of potash and the reason for these results in a plant which is cultivated for its sugar, a constituent which potash manuring is generally believed to favour, certainly demand closer study. In Assam the potash manuring has been found distinctly beneficial, both yields and sucrose content improving as the result. Reference is made to the very high doses of nitrogen up to 200 and 250 lbs. per acre used with advantage in Mysore and the inconclusive effect of sulphate of potash. The question of organic *versus* inorganic manures is then taken up and results bringing out the need for the use of organic manures in soils which are deficient in organic matter are referred to as well as the facts that sulphate of ammonia alone is able to bring about very large yields and that such manuring reduces the purity of the juice. The need for experiments continued over a long period of several years on this aspect of sugarcane manuring is stressed. Indeed the lacunae in the information on cane manuring are very numerous and nothing is more prominently clear from this summary than the need for accurate and long continued experiments.

A. K. Y.

THE COLABA OBSERVATORY

THE latest administration report of the India Meteorological Department publishes pictures of a barometer and a raingauge, two century-old instruments in use at the Colaba Observatory.

The Colaba Observatory at Bombay was erected in 1826, its site having been earmarked for it three years earlier, under the direction of the East India Company. Mr. Curnin was the first Astronomer. But it was not until 1841 that the observatory became an active centre when on the recommendation of the Royal Society, systematic observations began and the observatory was associated in research on meteorology and magnetism and also in time signal work. Thus it is that the current year is regarded as the centenary year of the Colaba Observatory.

In 1865 a committee of enquiry, set up by Government, recommended the installation of full equipments for magnetic and meteorological work, comprising the latest type of recording instruments and the appointment of a full-time and fully qualified officer to direct the work of the observatory. These recommendations were at once acted upon and Mr. C. Chambers was appointed Superintendent in 1865. The fruitfulness of the observatory under Mr. Chambers' direction is apparent from the large number of papers published by him in scientific journals, and by the volumes issued from the observatory during the years 1865 to 1894 which contain valuable contributions to the sciences of terrestrial magnetism and meteorology.

On the death of Mr. Chambers in 1896, Dr. N. A. F. Moos succeeded him. In 1898 a seismograph was set up to take part in the programme of observations started by the seismological committee of the British Association. In 1899 the control of the observatory passed from the Government of Bombay to the Government of India.

Owing to the decision to electrify the Bombay City at the beginning of 1900 and the consequent risk of disturbing the magnetic records obtained at the observatory, it became necessary to remove the magnetic work from Colaba to a place free from artificial disturbances. A new magnetic observatory was consequently built at Alibag and the magnetic work was permanently shifted to that place in 1906. By that time Colaba had the creditable record of more than 60 years of continuous magnetic records and in 1910, Dr. Moos published a comprehensive study of the whole, for the period 1846–1905 under the title "Colaba Magnetic Data", and this has remained a mine of information for later workers in the subject.

In 1930 regular observations on atmospheric electricity and potential gradient began to be taken. Studies of the changes of electric field associated with the movement of thunder-clouds and monsoon clouds have been made. The phenomenon of "earth-currents" has been investigated. Seismological work has been considerably extended and a quarterly Seismological bulletin containing the analysed data of the seismograms of all the Indian observatories is being issued from Colaba since 1937.

The observatories at Colaba and Alibag function as a centre for geophysical research in India. Their activities are directed to obtaining regular records of the phenomena of terrestrial magnetism, meteorology, seismology and atmospheric electricity, to the reduction and discussion of recorded facts and observations and to the publication of the results obtained. Star observations are taken for the purpose of time-keeping and the rating of marine chronometers. The observatory is equipped with various magnetic, meteorological, astronomical and seismological instruments.

CENTENARIES

Mendenhall, Thomas Corwin (1841–1924)

THOMAS CORWIN MENDENHALL, an American physicist, was born on a farm in Ohio, 4 October, 1841. He was largely self-educated. After leaving school in 1861, he taught mathematics and physics in various schools and became professor at the Ohio Agricultural and Mechanical College in 1873. In 1878 he was appointed professor of physics at the Imperial University of Tokyo. In 1881 he took up a similar appointment in the Ohio State University. In 1884 he joined the scientific staff of the Federal Government and retired in 1904.

While at Tokyo he established a physical laboratory and a meteorological observatory. He also measured the absolute force of gravity at Tokyo and its relative value in relation to that at Fujiyama. From these data, he determined the mean density of the earth and his value was considered best.

He invented an improved portable apparatus for the measurement of gravity. He was the first to propose the use of the ring pendulum for measuring the absolute force of gravity.

Though not a University man, he was given many honorary degrees and medals of learned societies. He was elected president of the American Association for the Advancement of Science in 1889.

Mendenhall died at Ravenna, Ohio, 22 March, 1924.

Hunt, Charles Wallace (1841–1911)

CHARLES WALLACE HUNT, an American engineer, was born at Candor, 13 October, 1841. After receiving his early education in the local institutions and serving in the war department for a short period he purchased a small coal business in 1868.

Not satisfied with the clumsy methods used for handling coal, in 1872 he invented a system by which coal was unloaded from cars or barges by cars which rose to inclined elevated tracks over which they travelled by gravity to all parts of the storage area. The little cars dumped automatically and were returned to the barges by the energy stored in weights which were raised by the cars during the loaded runs. This system was such an immediate success that he floated a new company to develop and manufacture it.

He also so improved the storage plants that he was called upon to build many large coal terminals throughout the world. It is said that his invention reduced the cost of handling coal to one-tenth the prior cost. His methods have since been applied to other materials as well.

He then turned his attention to the manufacture of industrial railway system, in which he was the first to make the system of units which could be purchased and combined to form any desired arrangement of tracks about a factory. He also experimented on flexible rope which resulted in his paper on *Rope driving* which remained for many years the best work on the subject.

Hunt died on Staten Island, New York, 27 March, 1911.

S. R. RANGANATHAN.
University Library,
Madras.

SCIENCE NOTES AND NEWS

Studies on the British White-flies.—The recent publication by Dr. K. N. Trehan [*Trans. R. Ent. Soc.*, London, 90, (22), 575] gives useful information on the species of British *Aleurodidæ*. He gives a complete account of their morphology, habits and food-plants and discusses their systematic position and parasites. The author has given conclusive facts in proving the synonomy of some of the important species and his descriptions of the immature and adult stages of the various species throw light on their systematics and morphology. The comparative study of the various forms yielded two new species (*Proc. R. Ent. Soc.*, London, (B) 7, 182). Besides, the author has also shown that colour variations exist even in the individuals of one and the same species (*Ind. J. Ent.*, 1, 71) and that the distribution of spines on the nymphs and pupæ, can in no way be considered a satisfactory taxonomic character. Both these characters, therefore, variable as they are, have no classificatory significance and cannot be adopted.

The importance of the 'vasiform orifice' and the genitalia has been thoroughly discussed and their reliability as significant diagnostic characters has been established. These characters have yielded valuable specific differences with the result that new species and genera have been erected and cases of doubtful nature have been properly dealt with. The entire work has been supplemented by the addition of keys for identification of adult as well as pupal characters.

It is believed that the paper under reference will prove of value in the investigations on Indian white-flies which demand our early attention. It is, therefore, hoped that the Imperial Council of Agricultural Research will take up this problem and provide necessary facilities with a view to investigating in detail the systematics and bionomics of the aleurodid fauna of India and compiling the available data about them on the lines similar to those adopted for the British white-flies. Since this group as a whole, including as it does pests of cotton, sugarcane, citrus and castor, is of considerable economic importance, it is hoped that it will receive the early patronage of the Council.

K. G. BHANDARI.

Nutrition Conference, Washington, 1941.—The National Nutrition Conference for Defence, summoned by President Franklin D. Roosevelt which took place in May (26–28) at Washington provided an opportunity "to explore and define the nutrition problems and to map an immediate programme of action" (*Experiment Station Record*, 1941, **85**, 1–4). The Conference was organised in nine sections among which the following may be mentioned: Research and National Nutrition Problems; Economic Policy and Social Responsibility as Related to Nutrition; Public Health and Radical Aspects of Nutrition; Nutrition for Workers in Defense Industries; Methods of Education in Nutrition; Professional Education in Nutrition and Nutrition Problems in Distribution and Processing of Foods. The Conference as a whole expressed its belief "that poor diets and undernourishment are widespread in this country" and that "while these conditions offer no grounds for alarmist statements, they are serious enough to be a genuine cause of weakness in the present national emergency and to warrant national attention and concerted action". The Conference urged the need for "vigorous and continuous research to add to our knowledge of the nutritional needs of individuals, the nutritional status of groups in the population, the nutritive content of everyday foods, and the effects of various methods of processing, storing, and cooking on their nutritive value". Section 1, relating to Research and National Nutrition Problems, dealt with all the principal lines of inquiry in the nutrition field. Sufficient information is available for formulating adequate dietaries at several cost levels, for recognizing several specific types of malnutrition, for conserving nutrients

in foods and for utilizing synthetic vitamins to supplement deficient dietaries. Further research was considered necessary in the following fields: (1) Improvement of presently known chemical and biological procedures for estimating the amounts of the essential nutrients in foods and their physiological availability; (2) more refined technics for the detection of nutritional deficiency states, especially in the subclinical degrees of intensity; (3) more precise determination of the optimum and minimum requirements of human subjects for each of the nutrients, as influenced by age and physiological status (including pregnancy and lactation) and those factors which affect their utilization; (4) study of problems relating to the nutritional needs of the individual as influenced by constitutional inefficiencies, by suboptimal nutrition, by disease and convalescence; (5) studies directed toward clear definition of the physical status of the individual; (6) study of all factors affecting the nutritive value of foods and their preservation during the interval between production and consumption; (7) study of methods of preparation of foods for consumption so as to avoid losses of nutrients; (8) food habits and methods and effects of changing them. The section also authorised the appointment of a committee "to survey existing facilities in all the universities, agricultural and land-grant colleges, or other laboratories of the country fitted to carry out substantial portions of the general research programme outlined in the report as adopted, and include in this survey an estimation of additional funds which may be necessary to effect promptly and efficiently the execution of these researches."

The Conference advocated "more widespread education of doctors, social-service workers, teachers and other professional workers in the newer knowledge of nutrition".

Virus Detection.—A new method of detecting viruses, toxins, and poisons in liquids is disclosed in a patent issued to Irving Langmuir, 1932 Nobel Prize Winner, of General Electric Research Laboratory, Schenectady, N.Y.

Used in the method is a conditioned slide on which 47 layers of transparent barium stearate, each of 0·0000001 inch thick, have been formed. This makes it possible to apply to the slide a substance with a specific reaction toward the toxin, virus, or poison suspected present. The slide is dipped in the solution to be tested and, if the suspected substance is present, adsorption of a single layer of uniformly thick atoms or molecules of the substance will produce an increase in film thickness and a corresponding change in colour. The films are illuminated by sodium light, and changes in intensity of the yellow sodium light are measured.

Each type of substance in solution is expected to produce a characteristic increase in film thickness and corresponding colour change. Once standards for known substances have been determined, identification of suspected substances will be a matter of check and comparison. Katharine B. Blodgett and Vincent J. Schaefer of the research laboratory staff have assisted Dr. Langmuir in the investigations, which started in 1935.—(*Current News of Chem. and Chem. Eng.*, 1941, 19, 377.)

Insect Pests of Jute.—For the protection of jute plants from insect pests, detailed life-histories of the parasites are being worked out at the Jute Research Laboratories of the Indian Central Jute Committee (*Bulletin of the Indian Central Jute Committee*, Sept. 1941). Attempts are made to devise suitable control methods for each pest, and the economics of control-measures is kept in the fore-front of the investigations. For example, while it has now been discovered that both the indigo-caterpillar and semi-looper can be controlled by spraying with lead-arsenate, it has also been ascertained that other agricultural and biological measures, besides being cheaper, are equally efficient if carried out in time. Growing of protective *til* borders around jute is quite efficacious against indigo-caterpillars. If perches are provided when the crop is only two feet high, the birds will prey on semi-loopers and keep them in check. But once the pests have got out of hand, only spraying with lead-arsenate will control the indigo-caterpillar and semi-looper.

Malaria Institute of India.—Whilst the research activities of the Institute have been restricted owing to war conditions, there has been an expansion of the training courses held during the year, says the Annual Report of the Malaria Institute of India for 1940. Special courses have been arranged for military personnel, whilst for the first time malaria courses for Engineers were held at the Field Station of the Institute in Delhi. The latter were attended by 61 Engineers, representing various branches of their profession, from widely seperated parts of India.

Officers of the Institute have continued to supervise the anti-malaria campaign which has been carried on in and around Delhi over an area of 55 square miles. Advice has also been given regarding the rural malaria schemes which are in progress in different parts of India. Special research units have carried out investigations in the Wynaad, South India, in the United Provinces Terai and in the neighbourhood of the Chilka Lake, Orissa.

A number of publications dealing with various branches of malariology have been published by members of the staff, and advice on malaria control measures has been given to a number of workers throughout India. In addition to malaria, problems connected with filariasis and the possible introduction of yellow fever into India have been dealt with.

Fish which feed on the larvæ of mosquitoes have been supplied to various health authorities from the hatchery maintained in Delhi. A number of larvicides and insecticidal sprays have been tested at the Field Station, and the routine examination and identification of mosquitoes sent to the Institute from different parts of India have been carried out as in previous years.

On April 1, 1940, the Public Health section of the Institute was taken over by the Government of India. Prior to that date, the whole of the activities of the Malaria Institute of India were financed by the Indian Research Fund Association.

Flora of the Punjab and the Associated Hill Regions.—Dr. T. S. Sabnis has continued in Part II (*J. Bombay Nat. Hist. Soc.*, 1941, 42,

No. 2) the list of plants reported in Part I. The locality and distribution of each species is given. The flora of the Punjab and the Associated Hill Regions will appear in several parts of which two are now published.

L. S. S. K.

The Centenary of the Chemical Society, London, was celebrated on April 3. At the annual meeting Sir Robert Robinson, the retiring president, delivered an address. Dr. J. C. Philip was elected president for the coming year.

The Society was inaugurated in 1841 by Mr. Warington with seven or eight other members of the Mathematical Society of Spitalfields. In 1848 the Society obtained a Royal Charter. The Society has on its roll several distinguished scientists among whom mention may be made of the following: Graham, Hofmann, Williamson, Faraday, Joule, Balard, Bunsen, Cannizzaro, Chevreul, Dumas, Gay-Lussac, Helmholtz, Kekulé, Laurent, Liebig, Mendeléef, Pasteur, Stas, Thénard, Wöhler, and Wurtz.

Thin Glass for Microscope Cover-slips.—The year 1940 marked the centenary of the manufacture, in Great Britain, of specially thin glass for microscope cover-slips. Prior to this date, it was customary for microscopists to use thin talc or mica for covering specimens to be examined under the microscope. This manufacture was started by *Messrs. Chance Brothers and Co., Ltd.*, at Smethwick, in 1840 as nearly as is known, and has been carried on continuously by the same firm up to the present day. The war has called for a considerable increase in supplies of such glass, both in Great Britain and abroad. There was no essential change in this type of glass until about 1926, when a research was carried out on the development of microscope cover-slips. It was found that the old type of glass which was essentially like window glass, would not withstand tropical conditions without becoming clouded. Therefore new methods of manufacturing a glass which would withstand sterilizing and exposure to tropical atmospheres without any deterioration were introduced. The thickness of cover-slip glass is still classified under the headings: Extra thin (0·075-0·100 mm.), No. 1 (0·100-0·167 mm.), N. 2 (0·167-0·215 mm.), and No. 3 (0·215-0·300 mm.). These correspond closely with the figures quoted in a catalogue issued by the firm in March 1859, which says No. 1 is 1/250 in. in thickness, No. 2 1/160 in., and No. 3 about 1/100 in.

—(*Nature*, 1941, 147, 803).

Scientific and Industrial Laboratories in Canada.—A bulletin giving the results of a survey of scientific and industrial laboratories has recently been completed by the Dominion Bureau of Statistics in collaboration with the National Research Council. The inquiry, the first of its kind ever undertaken in Canada, was designed primarily to secure information necessary for the effective prosecution of the war but the statistical data obtained were considered of sufficiently general interest to warrant the publication of a report thereon.

An important feature of the bulletin is the appended directory of laboratories, prepared in the Research Plans and Publications Section of the National Research Council, which lists, by ownership, the names and addresses of the industrial and scientific institutions which co-operated in the survey. The urgency of the demand for the information respecting laboratory facilities made it inexpedient to attempt a complete census of laboratories at the time the inquiry was undertaken, but it is felt that the survey includes practically all the more important and better equipped institutions, as well as a large majority of the smaller laboratories in Canada. The industrial section of the directory is accompanied by a key, by the use of which the types of work the various laboratories reported themselves as equipped to carry on, may be identified.

Copies of the Survey of Scientific and Industrial Laboratories, N.R.C. No. 961, may be obtained on application from the National Research Council. The price is $1.00, and remittance should accompany the order.

Indian Central Cotton Committee: Technological Laboratory.—"A feature of the year is the arrangement entered into between the Indian Central Cotton Committee and the Supply Department of the Government of India, whereby the Laboratory has been recognised as the official testing house for cotton mills in the Bombay Province, and the reports issued by it are accepted as being authoritative", states the Report of the Director, Technological Laboratory, for the year ending May 31, 1941, just published. This arrangement has proved helpful to the mills in the Bombay Presidency in getting their development samples and samples submitted against tenders tested expeditiously, and has at the same time brought the work of the Laboratory in close touch with the textile industry.

"Last year, the total number of samples tested at the Laboratory was 768, as compared to 1,800, during the year under review. A new section has been added to the Laboratory for the study of the ginning problems of Indian cotton and the machines required for the purpose have been installed. Some preliminary ginning tests with different speeds and settings on several varieties of Indian *kapas* have also been carried out.

"The samples tested at the Laboratory are dealt with in spinning test, yarn test and cloth test reports, which are issued on these samples. Last year, the number of these reports stood at 261, as against 1,046 during the year under review. Among the tests made on samples received from agricultural officers were Jarila cotton, which is now spreading rapidly in Khandesh; "Agmark" samples of 1027 A.L.F. from Baroda and adjoining British territory; medium-long staple cottons which are being tried in Bengal; and Gaorani-6 which is now cultivated over a fairly large area in Hyderabad State.

"The Laboratory investigated the causes of difficulties referred to by various mills, such as tendering of cloth, appearance of stains and the presence of holes in the cloth and the reports issued to the mills contained suggestions for preventing such defects.

"The technological investigations under progress included the pre-cleaning and ginning of Indian seed cottons on different machines and with different settings and speeds, the effect of different treatments in the blow-room, effect of storage under Bombay conditions on the quality of Indian cottons, the influence of swollen hair diameter on the spinning quality of cottons, fibre properties in relation to seed characters, efficiency of kier boil and bleach treatments.

"Work on Indian linters was continued during the year, and samples of linters for the past two seasons were analysed both by mechanical treatment and chemical process and the relationships between the results of the two treatments were worked out."

Tata Iron & Steel Company, Limited.—The annual report for the year 1940–41 reveals that, during the year, a large number of new schemes were taken on hand and successfully worked. Thus, the manufacture of bullet-proof armour plate steel has been developed and such steel is being made for the requirements of armoured vehicles in India. Special steels have been developed for armour piercing bullets and shells, for machine guns as well as for rifle and machine gun magazines and for drawing into telegraph wire. Research has been successfully pursued in connection with the welding of chrome molybdenum steel required for aircraft. The company is in a position to manufacture a large variety of special steels which had so far been imported. During the year, work was started on the erection of the new steel-making plant forming part of the current programme of expansion of the Works. This plant will produce steel by an entirely new process developed at Jamshedpur, which will not only enable steel to be made more rapidly than by other processes but will also enable acid steel to be produced for the first time out of purely indigenous materials. The plant is expected to be in operation before the expiry of the current year. An electrode-making plant for the manufacture of welding electrodes was put into operation in December 1940. A plant for manufacture of wheels, tyres and axils is being erected, and when this comes into operation, it will be possible to manufacture in India all the component parts required for railway locomotives.

Fishery Technology.—The Government of Madras have directed the establishment of an Institute at Tuticorin for the training of teachers in Fishery Technology, after their regular training in teachers' training schools. The Institute is intended to provide for a course of instruction to fishermen and others in all branches of fishing industry, including navigation.

The Institute will be started with 25 students. The duration of the training will be one year and for those who wish to specialise it will be extended to 2 or more years. *The Bharati Mahajan Sangam* and others will award 15 scholarships for the students of their community and the Government will provide for a grant of six stipends. A fee of Rs. 5 will be charged for students outside the Presidency.

Calcutta University.—Mr. Nirmalendunath Ray, M.Sc., has been admitted to the Degree of Doctor of Science in consideration of his thesis entitled "A Study of the analogy of the Complexes fluoberyllates and sulphates".

University of Mysore.—The Institution of the Degree of Master of Engineering and the Doctorate [D.Litt., D.Sc., D.Engg., D.Sc. (Anatomy and Physiology)] has been sanctioned.

The following extension lectures were delivered:—Dr. R. E. Heilig: "Vitamin and Preservation of Health"; Dr. C. S. Pichamuthu: "Was Mysore ever under the Sea?"; Dr. D. Jivanayakam: "Mass Education in India"; Madamme Sophia Wadia: "Ideas which Rule the World"; Dr. L. Sibaiya: (1) "Architecture of Atoms"; (2) "Atoms and Spectra".

Imperial Agricultural Research Institute, New Delhi.—The following students of the Institute have been awarded the Diploma of the Institute (Assoc. I.A.R.I.) after the completion in September 1941, of their two-year post-graduate courses and the acceptance by the Institute Council of theses submitted by them as mentioned against each:—

Botany—

(1) D. Srinivasachar: "Studies in the classification of *Oleiferous brassicæ* in India. (2) A. R. Braganza: "Seed and Embryo weight in its Relationship to Heterosis". (3) K. D. Sharma: "Morphology and classification of the varieties of *Solanum Andigenum* Juz. *et* Buk. and their breeding value."

Agricultural Chemistry—

(4) D. K. Patel: "Studies on Phosphate—Fixation in Indian cultivated soils." (5) M. K. Reddy: "The study of the Plate and the direct methods for the estimation of total Bacterial numbers in the soil with special reference to the variation of sampling errors with grain size."

Entomology—

(6) Shumsher Singh: "A contribution to the study of Indian *Terebrantia* classification of Terebrantia with a Systematic Account of the North Indian genera and species, their distribution and food plants." (7) Chandra Narain Modawal: Part I.—"Studies on the Life-history and Bionomics of *Chilomenes sexmaculata* Fabr., and its Predatory Efficiency in the Biological control of Aphids." Part II.—"Review of previous work on the more important pests of cotton in India."

Mycology—

(8) Syamaprasad Ray Chaudhuri: (i) "Studies on the canker disease of pigeon-pea [*Cajanus cajan* (L) Millsp.] caused by *Diplodia cajani* Nov. spec." (ii) "Studies on *Erysiphe cichoracearum* Dc and *Erysiphe polygoni* Dc.

Sugarcane Breeding—

(9) Gur Prasad Seth: Part I.—"Sugarcane Breeding as adopted at Coimbatore." Part II.—"Different factors in Sugarcane germination with special reference to nature of soil, its moisture content and variety." Part III.—"A possible method for selecting high yielding sugarcanes. (10) Jagdish Narain Sharma: Part I.—"Sugarcane Breeding at Coimbatore." Part II.—"Age determination of a sugarcane

culm." Part III.—"On the formulæ of branching system of some of the sugarcane varieties in relation to poor harvest in some of them." Part IV.—"A preliminary study of root primordia in certain sugarcane seedlings and their parents.

The following students have successfully completed the one-year post-graduate course in Agriculture:—

(1) Kanshi Ram Chowdhry. (2) K. L. Gurnani.

ASTRONOMICAL NOTES

Planets during November 1941.—Venus continues to be a very brilliant object in the western sky visible for nearly three hours after sunset; it reaches greatest elongation from the Sun (47° 16′ E.) on November 23 when its stellar magnitude will be −4·0. It will be bright enough to be seen, when carefully looked for, even during daytime and will cast a faint shadow by night. Mercury is a morning star and will be at its greatest elongation (19° 11′ W.) on November 12; will also be bright at the time, the magnitude being −0·3. Mars will be gradually decreasing in brightness, but is still a prominent object in the evening sky, setting about three hours before sunrise. It will be stationary on November 12 when it resumes its eastward motion among the stars. The Moon will be in close conjunction with the planet on November 1 and again on November 28.

Jupiter rises about an hour after sunset and is very conspicuous in the night sky during the month; its magnitude increases to −2·3. Saturn is in opposition to the Sun on November 18 and will be on view nearly the whole night as a bright star of magnitude −0·1. The ring ellipse will reach the maximum width for the year, the angular dimensions of the axes being 46″·1 and 18″·2. Uranus which is close by, will be in opposition on November 21, and can be seen as a faint star (magnitude 5·9) just visible with the naked eye about 4° south of the beautiful star cluster Pleiades.

The Leonid meteoric showers are due to appear about the middle of the month; the date of maximum display is November 16 and the meteors may be looked for about a week before and after that date. The radiant point is given by R.A. 151°. Declination 23° N. Another well-known shower due to appear in November is the Andromedids, the approximate date of maximum being November 17–27. The position of the radiant is R.A. 25°, Declination 44° N. and the meteors of this group are characterized by very slow short paths.

T. P. B.

SEISMOLOGICAL NOTES

During the month of September 1941, two slight and eight moderate earthquake shocks were recorded by the Colaba seismographs as against four moderate and six slight ones recorded during the same month in 1940. Details for September 1941 are given in the following table:—

Date	Intensity of the shock	Time of origin I. S. T.		Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	Remarks
September 1941		H.	M.	(Miles)		(Miles)	
4	Moderate	15	52	5560	Near Lat. 8° S., Long. 153° E., in the neighbourhood of New Britain		
9	Moderate	12	50	5660	Apparently in the neighbourhood of New Britain	Deep	
10	Slight	15	41	490			
11	Moderate	03	24	2250			
12	Moderate	12	33	3870			
17	Moderate	03	13	6930			
17	Moderate	12	18	3370			
22	Slight	00	23	1490			
24	Moderate	06	31	4950	Lat. 47°·7 N., Long. 158°·4 E. in the neighbourhood of the Kurile Islands in the North Pacific		
29	Moderate	08	02	840	Lat. 29°·9 N., Long. 67°·2 E. within 20 miles from Quetta		Reported to have been felt strongly in Quetta and its neighbourhood

MAGNETIC NOTES

The average magnetic activity in the month of August 1941 was slightly more than that in the preceding month. There were 1 quiet day, 21 days of slight disturbance and 9 of moderate disturbance as against 6 quiet days, 23 slightly disturbed and 2 moderately disturbed days in August 1940. On the 4th August 1941, the magnetic activity was the highest and on the 8th August, the least. The character figures of individual days in August 1941, are given below:

Quiet days	Disturbed days		
	Slight	Moderate	Great and very great
8	1, 3, 7, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 25, 26, 29, 30 & 31	2, 4, 5, 6, 17, 18 24, 27 & 28	Nil

A moderate disturbance suddenly commenced at 1^h 28^m G.M.T. on 4th August 1941, and ended at 2^h 30^m G.M.T. on the next day. There were no magnetic disturbances during the same month in 1940. The mean character figure for the month was 1·26 as against 0·87 for August 1940.

ANNOUNCEMENTS

University of Bombay.—The following awards have been announced. Intending competitors, who should be graduates (or undergraduates in the case of 2) of the University of Bombay, should send in their essays on the subjects notified before the last Monday in September, 1942; the last date for sending the essay for the Ashburner Prize is last Monday in September 1943. Essays should be typewritten or written in a neat legible hand and should not exceed 100 pages in length. Further details can be had from the Bombay Government Gazette, October 2, 1941:

1. *The Monockjee Limjee Gold Medal*, 1942. (Rs. 175. The winner will also receive a prize of Rs. 425 in cash or books.) "The contribution of the Indian Scientists to the development of industries in India."
2. *The Homejee Cursetjee Dady Prize*, 1942. (Rs. 600.) "Aviation with special reference to Indian conditions."
3. *The Dossabhoy Hormusjee Cama Prize*, 1942. (Rs. 630.) "Undernutrition in India, a survey of its effects and methods for overcoming it."
4. *The Ashburner Prize*, 1943. (Rs. 240.) "The need for planning a programme of Indian agriculture with reference to economic and industrial requirements of the country."
5. *The Pandit Bhagwanlal Indraji Gold Medal*, 1942. (Rs. 175.) "Prehistoric cultures of India."

Carmichael Medical College Silver Jubilee Celebration.—The authorities of the Carmichael Medical College and Hospitals have decided to celebrate the Silver Jubilee of the Institution towards the end of this year.

Sir Nripendranath Sircar has been elected Chairman of the Jubilee Committee. A Working Committee with Sir Nilratan Sircar as Chairman and nine sectional committees have been formed to work out the details of the programme.

The authorities of the Institution, in celebrating its Jubilee, consider the function as one of stock-taking. While its achievements and growth have been remarkable, they realise that much more remains to be done.

The Jubilee Celebration Committee looks forward to the sympathy and support of every one interested in the development of scientific institutions in this country, in their work.

Chronica Botanica Co., Waltham, Mass., U.S.A.—The following plant science books are due to be published shortly:—

"Forest Tree Seed," by H. I. Baldwin, Research Forester, New Hampshire Forestry Dept. Summarizes existing information on the collection and treatment of tree seeds prior to sowing, the physiology of seed, and methods of testing for germination and other qualities. Research methods, and co-operation in research are stressed. A selected bibliography and a polyglot glossary of terms will be included. *In the press, ready shortly.* About 240 pages, illustrated, buckram, $4·50.

"Cytoplasm," by A. Guilliermond, Professor of Botany at the Sorbonne, Paris. Authorized American translation by Lenette Rogers Atkinson of Amherst, Mass. A critical review of our present knowledge of the cytoplasm and its morphological constituents by the eminent French cytologist. Morphological, physical and chemical properties of the cytoplasm. Plastids, Chondriosomes, Vacuome, Microsomes. Other cytoplasmic formations. Cytoplasmic alterations. Vital staining. Modern conceptions in plant cytology, etc. *Ready shortly.* About 250 pages, over 150 illustrations, buckram, $4·50.

"An Introduction to Pollen Analysis," by G. Erdtman, Vasteras, Sweden. An account of the principles and methods used in research on pollen, especially in pollen analysis of peat, and an outline of the more important results so far achieved. The practical applications of pollen research to archæology, forestry, phytogeography, etc. are fully treated. Special consideration is given to the experimental aspect of the problems involved and to possible lines of approach to new fields of activity in this rapidly growing branch of science. From the contents: Pollen preparations, Bog investigations, Preparation of samples, Pollen production, Wind transport, Pollen and spore morphology (mosses, ferns, gymnosperms, angiosperms), Pollen diagrams and their interpretation. *Ready shortly.* About 240 pages, illustrated, several hundred original drawings, buckram, $5·00.

"A Short History of the Plant Sciences," by Howard S. Reed, Professor of Plant Physiology, Univ. of California. The discovery of plants and their cultural uses by ancient peoples. Botany of the Greeks, Romans, Chinese and

Arabs. The renaissance of scientific botany in Europe. Botanical explorers: the effects of the discovery of the New World. Contributions of botany to agriculture and forestry. The rise of specialization: its results in the nineteenth and twentieth centuries. Reviews of investigations in the specialized fields of botany and related sciences. To be published shortly. About 240 pages, illustrated.

"Carnivorous Plants," by Francis E. Lloyd, Professor of Botany Emeritus, McGill Univ. A general and full account of the carnivorous plants of the world, of which upward of 500 species belonging to 15 genera are known among the flowering plants and several others among the fungi. The descriptions, embracing their appearances, habitats, geographical distribution, anatomy and morphology and so much of their physiology as is concerned with the carnivorous habit, are based in large part on the Author's personal study of material of all types derived by exploration and by correspondence with botanists in all parts of the world. Fully illustrated with original drawings and half-tones, some 250 figures in all. In preparation, ready shortly.

Symposium on Corrosion.—An outstandingly successful symposium on the extremely important subject of corrosion was organised by Section C of the American Association for the Advancement of Science, with the assistance of a special co-ordinating committee of representatives from practically all the important scientific and technical associations in America. The symposium was held during the first week of August, and was attended by nearly 70 invited corrosion specialists; including among others F. N. Speller, William Blum and H. H. Uhlig. A variety of corrosion aspects were discussed: *e.g.*, "Statistical methods in corrosion studies," "Protection of metals with metallic coatings," "Anodic oxide and surface conversion coatings," "New corrosion resistant steels," "Corrosion of metals by soils," "Theory of cathodic protection," etc.

* * *

We acknowledge with thanks, receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 89, Nos. 4590–91.

"Journal of Agricultural Research," Vol. 62, Nos. 10–12.

"Agricultural Gazette of New South Wales," Vol. 52, Part 8.

"Indian Journal of Agricultural Science," Vol. 11, Part 4.

"Biochemical Journal," Vol. 35, No. 4.

"Journal of Chemical Physics," Vol. 9, No. 8.

"Journal of the Indian Chemical Society," Vol. 18, Nos. 6 and 7.

"Experiment Station Record," Vol. 85, No. 1.

"Indian Forester," Vol. 67, No. 10.

"Transactions of the Faraday Society," Vol. 37, Parts 6 and 7.

"Indian Farming," Vol. 2, No. 9.

"The Review of Applied Mycology," Vol. 20, Part 6.

"Bulletin of the American Meteorological Society," Vol. 22, No. 6.

"Journal of the Indian Mathematical Society," Vol. 5, No. 2.

"Journal of Nutrition," Vol. 22, No. 2.

"Nature," Vol. 147, Nos. 3738–39; Vol. 148, Nos. 3740–42.

"The Philippine Journal of Science," Vol. 75, No. 2.

"Indian Journal of Physics," Vol. 15, Part 3.

"Journal of Research" (National Bureau of Standards), Vol. 27, No. 1.

"Sky," Vol. 5, Nos. 10–11.

"Science and Culture," Vol. 7, No. 4.

"Sankhya," Vol. 5, No. 3.

"Indian Trade Journal," Vol. 142, Nos. 1838–41.

Books

"Chemical Species," by Jean Timmermans. (Macmillan Co., London), 1941. Pp. viii + 177. Price 18*sh.*

"Mercerising," by J. T. Marsh. (Chapman & Hall, London), 1941. Pp. xv + 458. Price 32*sh.*

"Surge Phenomena, Seven Years' Research for the Central Electricity Board (1933–40)," published by the British Electrical and Allied Industries Research Association, London, 1941. Pp. viii + 426. Price £2–10–0.

"Intermediate Electricity," by Robert W. Hutchinson. (University Tutorial Press, London) (Cambridge University Press, Bombay), 1941. Pp. viii + 628. Price 12*sh.* 6*d.*

"The Photochemistry of Gases," by William Albert Noyer and Philip Albert Leighton. (Reinhold Publishing Co., New York), 1941. Pp. 475. Price $10·00.

"The Second Year-book of Research and Statistical Methodology," edited by Oscar Krisen Buros. (The Gryphon Press, New Jersey), 1941. Pp. xx + 383. Price $5·00.

ACADEMIES AND SOCIETIES

Indian Academy of Sciences: (*Proceedings*)

September 1941. SECTION A.—SIR C. V. RAMAN, V. S. RAJAGOPALAN AND T. M. K. NEDUNGADI: *Conical refraction in naphthalene crystals.* The angles of internal and external conical refraction for naphthalene are exceptionally large (13° 45′) and the substance is well suited for exhibiting these phenomena as well as for a critical study of same. The so-called Poggendorff circle appears only in internal conical refraction and is an ultra-focal phenomenon. SIR C. V. RAMAN: *New methods in the study of light scattering. Part I. Basic ideas.* A method is described, based upon the use of a Nicol for polarising the incident beam in any desired azimuth, and of a Babinet compensator for observing the transversely scattered light which enables the Krishnan effect to be very conveniently studied. T. A. S. BALAKRISHNAN: *New methods in the study of light scattering. Part II. Pure liquids.* Using a Babinet compensator with an analysing nicol oriented so as to transmit vibrations in the plane of observation, the author has established the presence of a feeble partial polarisation in the scattered light. T. M. K. NEDUNGADI: *Studies on the Raman effect in single crystals of potassium nitrate.* New lattice vibrations at 100, 126 and 143 are recorded. These disappear just below the transition temperature of 129° C. There is no conspicuous change in the internal oscillation frequency shifts due to change of state. T. A. S. BALAKRISHNAN: *Effect of crystal orientation on the Raman spectrum of barytes.* None of the three orientations of the crystal gives the complete Raman spectrum, some of the components vanishing in particular orientations, while the intensities of the others vary. P. SURYAPRAKASA RAO AND T. R. SESHADRI: *Constitution of cannabiscitrin.* Cannabiscitrin is a monoglucoside of the flavanol cannabiscetin, carrying the sugar group in the side phenyl nucleus in the 3′-position. S. V. ANANTAKRISHNAN AND S. KRISHNAMURTI: *Kinetic studies in ester hydrolysis. Part I. The hydrolysis of halogeno-aliphatic esters.* S. V. ANANTAKRISHNAN AND S. KRISHNAMURTI: *Kinetic studies in ester hydrolysis. Part II. The influence of solvent on the reaction.* P. SURYAPRAKASA RAO AND T. R. SESHADRI: *Isolation and constitution of quercetagitrin, a glucoside of quercetagetin.* T. R. SESHADRI AND V. VENKATESWARLU: *Nuclear methylation of β-resorcylic aldehyde.* K. NEELAKANTAM AND L. RAMACHANDRA ROW: *The constitutional features of anthoxanthins in relation to the morin reaction in analytical chemistry. Part I. Some naturally occurring hydroxy-flavonols and flavonones.* SAHIB RAM MANDAN: *A relation between a pencil and a range of quadrics.*

SECTION B.—BHOLA NATH SINGH: *The growth of the sugarcane plant in India. Part I. Age-fertiliser effects on the physiology and chemistry of sugarcane.* SYED IMDAD HASSAN: *The shell and the mechanism of its closure in the Indian pond terrapin, Lissemys punctata punctata (Bonnaterre)* . VIJAY PRATAP SINGH: *On a collection of algæ from the Chamba State,* Panjab—I. VIJAY PRATAP SINGH: *The chlorophyceæ of the Benares district, India—I.* T. C. SAPKAR: *The alteration of radioactive minerals.* G. W. CHIPLONKER: *Ammonites from the Bagh beds.* RUSTOM JAL VAKIL: *An analysis of two hundred normal electrocardiograms.* P. KRISHNA RAO: *Infantile cirrhosis of the liver.* G. D. BHALERAO: Subulura minetti *n. sp. (Nematoda from an Indian fowl.*

Indian Association for the Cultivation of Science: (*Proceedings*)

June 1941.—(MISS) CHANDRAKANTA: *Measurement of acoustical impedances.* G. R. PARANJPE AND D. J. DAVAR: *Determination of dipole moment in solution.* N. RAJESWARA RAO: *Electrolytic dissociation in Nitric acid as studied by Raman effect.* D. S. SUBRAHMANYAM: *Friction between a liquid surface and a solid not wetted by it.* N. R. SEN: *On a theoretical estimate of an upper limit of Stellar diameter.* N. R. SEN: *On some thermodynamic properties of a mixture of gas and radiation.* J. G. BECKERLEY: *The calculation or arg* $\Gamma(ia + i)$. H. BOSE AND B. B. RAY: *Allotropies of tellurium by X-ray diffraction method.*

August 1941.—S. M. KERAWALA: *A rapid method for calculating the least squares solution of a polynomial of degree not exceeding the fifth.* H. BOSE: *Investigation of tellurium and arsenic sulphide in the colloidal state.* CHAMAN LAL: *Measurement of the angle of incidence at the ground of downcoming short-waves from the ionosphere.* B. SWAMINATHAN: *The short wave condenser field.*

Indian Chemical Society: (*Journal*)

July 1941.—A. L. SUNDARA RAO: *Studies in hydrogen bond formation. Part I. Amides.* S. S. BHATNAGAR, N. A. YAJNIK, P. L. KAPUR AND ANAND SWARUP BHATNAGAR: *Magnetism and catalysis. Part III. Chlorination of chloroform to carbon tetrachloride in presence of Ferric chloride.* R. K. BAHL AND MANOHAR LAL: *The action of chlorine on the hydroxides of iron and chromium in the presence of iodine.* G. GOPALARAO AND CH. I. VARADANAM: *Photosensitisation of solids. Part III. Photosensitised oxidation of ammonia in aqueous solution with colloidal titania as the photosensitiser.* S. S. BHATNAGAR, P. L. KAPUR, ANAND SWAROOP BHATNAGAR AND BRAHM PRAKASH: *Magnetism and catalysis. Part IV. Catalysis of the reaction between ammonium oxalate and mercuric chloride by ferric ions.* JYOTIRMOY DAS-GUPTA: *micro-analytical method for the estimation of ferrous and ferric iron in minerals.* JYOTIRMOY

DAS-GUPTA: *Microchemical investigations on spotted muscovite mica.* P. V. KRISHNAMURTHY: *Complex formation by ascorbic acid with formaldehyde.*

Indian Botanical Society: (*Journal*)

October 1941.—P. MAHESHWARI: *Recent work on the types of embryo-sacs in Angiosperms—A critical review.* V. PURI: *The life-history of* Moringa oleifera *Lamk.* GHIAS-UD-DIN AHMAD: *The growth of* Azolla filiculoides *in mineral solution without addition of 'Auximone'.* M. J. THIRUMALACHAR: Hapalophragmium ponderosum *Syd. on* Acacia leucophlæa *Willd.* B. G. L. SWAMY: *Contributions to the life-history of* Bignonia megapatomica. T. S. RAGHAVAN AND A. R. SRINIVASAN: *Cytogenetical studies in nicotiana.* T. S. RAGHAVAN AND K. RANGASWAMY: *Studies in the Rubiaceæ.* K. N. SESHAGIRIAH: *Morphological studies in Orchidaseæ. I.* Zeuxine sulcata *Lindley.*

Geological, Mining and Metallurgical Society of India: (*Journal*)

The latest issue of the *Quarterly Journal of the Geological, Mining and Metallurgical Society of India* (*Vol.* XII, No. 4) contains a short paper by Mr. K. L. Bhola on Fuller's Earth deposits of Jodhpur State, Rajaputana. After giving a brief account of the geology of the area in which these deposits are found, the paper proceeds to give a description of the different deposits, together with the results of the tests conducted on the suitability of this material for various purposes—from which it appears that the quality is fairly satisfactory.

Mining, Geological and Metallurgical Institute of India: (*Transactions*)

The recent number of the *Transactions of the Mining, Geological and Metallurgical Institute of India* (Vol. 36, Pt. 2) contains a report of the contribution by Dr. S. K. Roy to the Discussion on Mr. Hobson's paper on "The development of the mineral deposit at Mawchi as determined by its geology and genesis" read some time back before the Society. In the course of his observations, Dr. Roy offers an explanation of the fact that the tinstone veins pinch out at the approach of the limestone on the basis of the experimental work by Dubrée and Gay Lussac. He also refers to the view of Mr. Hobson that the Mawchi ores were not formed under conditions of slowly falling temperature but under conditions of rapidly decreasing pressure and points out that this is not quite in agreement with observations made by Niggli based on his and Smits' experiments in Carnegie Institute.

The *Journal* also contains a valuable paper by Mr. James Lomax on "Some aspects of Surveying in Indian Coal Mines", at the end of which there is also a full Report of the Discussion on this subject in which Messrs. W. Kirsby, K. B. Swami, C. Forrester, J. K. Dholakia, H. K. Nag and others have taken part.

Meteorological Office Colloquium, Poona:

September 9, 1941.—J. M. SIL: *Some aspects of fluid flow and fluid resistance.*

September 16, 1941.—S. MAL: *The structure and movement of western disturbances.*

September 24, 1941.—B. N. DESAI: Frontal *analysis of two winter depressions of Northwest India.*

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